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H. W. WILEY, Chief of Bureau.

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INSECTICIDE STUDIES.

- I. PYRETHRUM POWDERS CONTAINING POISONOUS METALS.
- II. A COMPILATION OF ANALYSES OF INSECTICIDES AND FUNGICIDES.
- III. STATE LAWS GOVERNING THE COMPOSITION AND SALE OF INSECTICIDES.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF CHEMISTRY,

Washington, D. C., March 15, 1903.

SIR: I have the honor to transmit for your approval three papers on insecticides prepared in the Insecticide and Agricultural Water Laboratory of this Bureau, and to recommend their publication as Bulletin No. 76 of the Bureau of Chemistry.

Respectfully,

H. W. WILEY,

Chief.

Hon. JAMES WILSON,

Secretary of Agriculture.

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INSECTICIDE STUDIES.

I. PYRETHRUM POWDERS CONTAINING POISONOUS METALS.

INTRODUCTION.

In the course of a recent examination of a large number of miscellaneous insecticides it was observed that a number of pyrethrum powders contained lead chromate. These powders are sold under such names as Persian Insect Powder, Dalmatian Insect Powder, Buhach, and Pyrethrum, and are colored yellow because there seems to be a popular demand for this grade of goods, the public apparently believing that the preparation must be bright yellow in order to kill insects. As a matter of fact pure pyrethrum, which is composed of the ground flower heads of *Pyrethrum roseum* and *Pyrethrum cinerariaefolium*, usually possesses a light yellow color, but never the bright, intense yellow color given to it by lead chromate.

As lead chromate is known to be poisonous, it would appear that it is a very reprehensible practice to add it to pyrethrum powders, since they are often blown about living rooms with a bellows to kill insects, and are consequently inhaled by human beings. Besides this, pyrethrum is always advertised to be harmless to human beings, which it is when pure, but ceases to be so when it has been mixed with lead chromate or other yellow colored chromates. In view of the above facts it was deemed advisable to examine the pyrethrum powders sold upon the American market to discover which of them contain yellow chromates and at the same time to cite cases of poisoning by chromates to substantiate the claim that any of the yellow chromates that might be used for this purpose, and especially lead chromate, are poisonous to human beings. The facts which have been collected on these points are embodied in the following report:

CASES OF POISONING BY LEAD AND OTHER CHROMATES.

Since it is not generally known that many pyrethrum powders contain lead chromate, it doubtless often happens that physicians are much puzzled as to the cause of the illness of persons who have been exposed to the action of such powders. In order, therefore, that physicians and others may recognize the symptoms of chromate

poisoning caused by this class of goods, the following account is given of cases of chromate poisoning found in medical records:

LEAD POISONING CAUSED BY THE MANUFACTURE OF FUSES FOR
LIGHTING PURPOSES. ^a

On February 22, 1875, a woman of about 46 years of age came under my care at the hospital. She complained of pains in the stomach and a general indisposition or breaking down. For a number of days she had suffered with severe gripes. Her stomach was not swollen, but her skin was very sensitive and palpation caused a contraction of the abdominal muscles. There was, however, no tumor in the abdominal cavity. She had suffered for about fifteen days with obstinate constipation that could be relieved only by an injection; her liver was small and not painful; her tongue white, appetite nearly entirely lacking, and breath foul. There was nausea and a distaste for food, and one could observe the existence of a grayish-black slate-colored border on the edges of her teeth next to the gums, which had all the characteristics of lead bands. That symptom, added to the gripes and to cramps in the calves of the legs during the night, caused me to diagnose the case as lead poisoning. This woman was under my care until the 16th of March, at which time she began to convalesce, although at that time she was still anæmic and feeble; but there was unquestionable improvement.

Being well convinced that my patient was suffering with lead poisoning, I thought I ought to find the cause. I found that she had worked for five years in a well-aired factory employing about 30 people, where they were engaged in the manufacture of fuses which were to be used by smokers to light their pipes and cigars. Her work differed from that of her fellow-workers in that she was employed in winding the cotton that was to be used for the manufacture of fuses, while they wove the threads of cotton. She was thus more exposed than her companions to the emanating dust, especially as the cold weather had obliged them to close the windows of the shop. These fuses were about as large around as a pencil or the little finger and of a yellowish orange color, indicating that they were colored with lead chromate. A chemical analysis showed the presence of this compound.

At the shop where these fuses were manufactured I found that those who were engaged in weaving them did not show any appreciable symptoms of lead poisoning, while those who were employed to shake out and wind the cotton all had fairly well developed cases. The merchant at Paris who manufactured these fuses said that they were originated in Germany, but were now exported largely, especially to America.

FATAL POISONING BY EATING CONFECTIONERY COLORED WITH LEAD
CHROMATE. ^b

On March 14, 187-, between 9 and 11 a. m., the two sons of Mr. H., aged respectively $3\frac{1}{2}$ and $1\frac{3}{4}$ years, ate several small ornaments representing bees that had been placed on a cake. In the afternoon of the same day they became very ill and were attacked with severe vomiting and great prostration. The vomited mass was at first yellow, and was thrown up with great pain. Vomiting continued until 11 p. m., after which it became infrequent. When the physician arrived, at 6 p. m., they were in bed and suffering extremely. They had reddened faces, complained of great thirst, were languid, had no dysentery, although they complained of slight pains.

^a Annales d'hygiène, 2d series, No. 44, 1875.

^b Vierteljahresschrift für gerichtl. Medizin, 1874, 20: 60.

It was easy to see that they had been poisoned, and since in the morning they had eaten the same food as the rest of the household, who remained in perfect health, probably the poisoning was due to the above-mentioned bees, seven of which had been given to the children to play with, while only one could be found. They finally confessed that they had eaten the remaining six, and the nurse had seen them do it. The nurse thinking it might be harmful, had taken a softened "bee" from the younger child and wiped out his mouth.

One of the "bees," of which more were found at the confectioner's who had made the cake, was examined by a chemist and found to consist of gum and lead chromate. On the following day both patients had the same red and heated faces; they showed no interest, and on being questioned gave tokens of displeasure. They did not complain of local pains, evidently because their senses were benumbed. The younger had some diarrhea and toward noon convulsions, from which his face was livid. The convulsions became more frequent toward evening, and at 9 o'clock on the morning of the following day, March 16, the younger boy died.

The older child still had a red, heated face and displayed no interest, being almost unconscious. The skin upon his breast and abdomen was strikingly red. The evening temperature was 39.5° in the armpits. On the 17th the pulse was irregular and the temperature in the evening 39.6° . Drinking was extremely painful, in spite of great thirst. On the 18th a foul smell came from the mouth, redness was still present, accompanied by stupidity and painful swallowing; temperature in the evening was 39.2° . On the 19th a collapse took place, a very foul smell came from the mouth, and swallowing was almost impossible. The senses were very much benumbed, and death followed at 11 a. m. The result of the post-mortem may be summed up in the words of the physician as follows: "The death of the children is the direct result of the destruction which has befallen the digestive canal from the throat to the duodenum. Concerning the cause of this destruction and concerning some further conditions we will not express an explicit opinion." The liver, stomach and contents, and urine were then subjected to a chemical examination. This gave negative results, except that in the liver of both corpses traces of copper were found, a discovery of no toxicological interest. The absence of all poisonous metals in all other parts of the corpses was shown.

The "bees" were also examined, and 0.27 gram of gum and 0.0042 gram of neutral lead chromate were found in one that was 13 mm long and 5 mm thick. The powder used by the confectioner was also analyzed and found to contain lead chromate. The illness of both children, occurring at the same time and showing itself by severe vomiting, must be traced back to their eating some poisonous food; and since it was known that they both ate the "bees" which contained lead chromate and that they vomited up yellow vomit, the eating of the metallic salt must be considered as the cause of the deaths.

It is not remarkable that no lead chromate was found in the alimentary tract, since the children vomited a great deal and thus threw up all of the poison.

FATAL POISONING BY INHALING DUST FROM YARN COLORED WITH LEAD CHROMATE.^a

On December 29, 1876, a weaver, B., at E., received a package of yellow threads, colored with lead chromate, which were to be used for the manufacture of curtains. B. and his mate, G., worked at one spool and Mrs. B. and a girl, L., at the other. They worked from 7 a. m. to 10 and 11 p. m. While they were working the threads shed powder, according to B.'s statement, so that their faces and hair became entirely

^aVierteljahresschrift für gerichtl. Medizin, 1877, 27: 29 (No. 1).

yellow. Their spittle appeared yellow, and the powder had a bitter taste. According to Mrs. B. the powder had a sweetish-bitter taste. The male helper sickened after working upon the threads about eight days; he had a headache, with a ringing in the ears, pains in his breast and stomach, and lost his appetite. He had a desire to vomit and was constipated. This continued for six weeks, until he ceased working and went to the doctor. Mrs. B. during the meantime became ill; she complained of loss of appetite and pains in the chest. B. on the last day of the third week of the work was attacked with pains in the stomach. Then appeared nausea, languor, and sleeplessness. Eight or ten days later he was obliged to stop work and send for the doctor on account of pains in the bowels and costiveness. The girl helper was also ill, having diarrhea, loss of appetite, and pains in the breast.

Dr. J. stated the symptoms of B. and the helpers in the following terms: Yellow-coated tongue and yellow expectoration, entire loss of appetite, nausea, temporary vomiting, and pains in the region of the navel, accompanied by obstinate constipation. The excrement was also colored yellow, and all the patients were very weak. The doctor stated that these symptoms were all caused by breathing yellow dust from the yarn and indicated plainly lead-chromate poisoning.

Although all of the above-mentioned persons finally recovered, B. lost a 9-weeks-old baby, whose death could be ascribed only to the breathing or swallowing of the yarn dust. When the B.'s noticed how much dust was flying about they sought to protect their baby by spreading a white woolen cloth of medium thickness over his face. This cloth was said to have been yellow with the dust all the time, as well as the bed on which the child was lying. The child's crib stood midway between the two B.'s stools and at night the mother took the child to bed with her. It was healthy and lively, so that continued poor feeding could not have caused the bad condition of the stomach (jelly-like softening and perforation) observed at the post-mortem. Suddenly, six or eight days before its death, which occurred on February 24, the child was taken sick. Its face became pale and its body hot. It had a couple of loose, yellow actions each day, which were accompanied by restlessness and frequent screaming. The skin upon the breast and stomach became red. In the beginning the baby drank, but refused to eat; later it drank with trouble, and on the day it died it swallowed with difficulty. The lips were dry, the breathing short, and death followed slowly. It is to be remarked that the child, after remaining healthy for six weeks in spite of the surrounding yarn dust, was suddenly taken sick six or eight days before death and grew worse at a time when the yellow yarn was not being worked upon. Since the child remained covered with the cloth up to the time of its death, it appears likely that the dust gradually worked its way through the cloth and sifted down so that the child always had to breathe this impure air until its death.

A chemical examination was made of the following organs of the child and the articles that were used at the time of his death: Contents of the nose, contents of the stomach, urine and gall taken from the urine and gall bladders, organs of the stomach and breast, the hair of the head, shirt slip, the child's nipple, and a portion of the yellow yarn. The brain would have been examined, but the vessel containing it was lost. The yarn contained 11.83 per cent lead chromate. Lead chromate was found in the hair of the head, and the little slip contained 65 mg lightly strewn over it. The organs of the neck, chest, and gullet contained 36 mg of lead chromate. The other fluids of the body and organs, the shirt, and nipple did not show the presence of any lead chromate.

It will thus be seen that numbers of authentic cases of poisoning, by either breathing or swallowing lead chromate, are on record. Following will be found several typical cases of poisoning by alkaline

chromates and bichromates selected from the large number that have been observed by Messrs. Delpech and Hillaire:^a

MEMOIRS CONCERNING DANGERS TO WHICH WORKMEN IN CHROMATE FACTORIES ARE EXPOSED.

OBSERVATION I.—*Workmen employed for a long time at the grinder (pilerie) and formerly at the kettles (chaudières)—Nasal partition perforated by the dust.*

V., aged 50, has worked for twelve years (1849) in a chromate manufacturing plant. He was employed from the beginning at the grinder and sifter, and is thus constantly enveloped in an atmosphere charged with fine chrome-iron powder. He says that he feels no indisposition. He wipes his nose and spits blackish matter, but neither coughs nor has any smothered feeling; his health appears to be good; he has no disease of the lungs; he does not believe there is anything the matter with his nose; however, his sense of smell was perfect when he entered the factory, and he has now completely lost it. The nasal passages were examined, and a perforation of the cartilage was observed. He says that since entering the factory he has sometimes worked at the kettles. At the commencement of this labor he was attacked with headache and swelling of the nose accompanied by an abundant discharge from the nostrils. His eyes did not smart. These symptoms lasted about fifteen days, after which he regained the most perfect health without even experiencing again the symptoms enumerated, although employed at the same work.

This workman has since (October, 1864) died after a few days' illness of inflammation of the chest, without having previously shown any prolonged symptoms of suffering with the respiratory organs.

OBSERVATION III.—*Workman employed at the kettles for about four weeks—Inflammation of the mucous membrane of the nose—Sore upon the right thumb—A nasal perforation—Ulceration of both of the external nasal walls.*

E., aged 28, who had a good constitution, had been employed for five weeks in a potassium bichromate manufacturing plant when he was examined by us. He was employed about eight days inside the works carrying the bichromate and for three weeks at the kettles. From the first day he was attacked by prolonged and intense sneezing. After four days he suffered greatly with intense prickling, abundant running of the nose, an incessant desire to blow his nose, and the passage of red membranous shreds. He had no watering of the eyes, or at most it was slight. The most severe symptoms lasted from ten to twelve days. He had nearly recovered when he stopped working at the kettle, and has since completely recovered. This workman still has his sense of smell. He was afflicted by a sore on his right hand, caused by penetration of particles of bichromate in a slight excoriation, and a slight ulceration still remains. One can also note brown spots, caused by sores of the same nature, upon the side of his face and on the ring finger.

E. has never suffered with his feet. He has no eruption either on the skin of his body or genital organs. His eyelids are not excoriated, and he has neither vomited, suffered with diarrhea, nor a cough. The nasal partition is perforated at the usual place.

^a Annales d'Hygiène Publique et de Médecine Légale, 1869, and 1876, 2d series.

OBSERVATION VI.—*Workman, a coppersmith unaccustomed to the manufacture of chromate, was exposed to the dust resulting from the repairing of the kettles—Inflammation of the mucous membrane of the nose and nasal perforation.*

F., a coppersmith and a stranger to the chromate factory, came into the factory for a short time to repair the kettles. This repairing required a readjusting of the sides by hitting with a hammer, and these blows caused the crust of bichromate that adheres in the slightest irregularities to fly about in the form of a dust. He was attacked quickly by inflammation of the mucous membrane of the nose and lost his nasal partition in eight days.

OBSERVATION XI.—*Superintendent, not employed at any special work—Chronic irritation, swelling of the membrane at the usual place, but no perforation.*

O., aged 20 (December, 1863), has been employed for four years in the chromate works. He has never worked at the kettles or the calciner. Charged with general surveillance, he merely walks through the works; in exceptional cases, however, he helps solder the lead crystallizing vats that are in need of repairs. He has consequently to a certain extent been subjected to the action of bichromate. At the time we examined him he had felt a tingling of the nose and had frequent fits of sneezing, but his nasal membrane had not been badly inflamed. His nasal partition is not perforated, but at the usual point he has a slight swelling and reddening of the membrane. His general health is good.

OBSERVATION XVIII.—*Fireman exposed to chromate dust—Perforation of the nasal cartilage, ulcerated sores on the right hand.*

D., aged 28, has been employed at the works for two years, and for the last ten months at the manufacture of potassium chromate. He is employed as a fireman, but often helps his fellow-workmen, and so during much of the time spent in the factory he is exposed to chromate dust. He had always enjoyed the best of health. He had never had syphilitic symptoms, but during his infancy the glands at the side of his neck were swollen for a long time. His general condition is good. He had worked at the manufacture of potassium chromate for scarcely fifteen days when he was taken with nose bleeding, sneezing, pain in the nose, and watering of the eyes. He sometimes experienced a little uneasiness in breathing. It was fifteen or twenty days after he had ceased to work at the preparation of potassium chromate that he examined his nose and found a small perforation. The nose preserves its normal form. There is an ulcer on the nasal cartilage in the right nostril, and at the edges of this the mucous membrane is very much inflamed. In the left nostril is an opening corresponding to this ulceration. His sense of smell is preserved; neither the throat, palate, nor roof of the mouth have been attacked, and he has no cough. This workman has hard, cartilaginous, livid scars upon his thumb and his right hand. On the left index finger there exists a sore which is much swollen and exudes a sero-purulent liquid. This workman has never had any swelling or ulceration of his feet.

There are many other observations cited in the above article, but enough have been given to show that persons who are obliged to breathe air charged with the dust from chromates or bichromates are nearly always affected more or less seriously.

ANALYSES OF PYRETHRUM POWDERS.

COLLECTION OF SAMPLES.

In order that samples of pyrethrum, representative of all grades, might be obtained, a circular letter was forwarded to the chemist of each of the experiment stations, with the request that they purchase for us, upon the open market, three or four samples of those products sold under the name of either Pyrethrum, Buhach, Persian Insect Powder, or Dalmatian Insect Powder. They were also asked to give data as to the price per two-ounce sample, the name and address of the retail dealer, and the name and address of the person who originally prepared the sample. In answer to these letters 105 samples were received, all of which were subjected to chemical examination. It is believed that these samples represent fairly well the present state of the American market.

Credit is due to the assistants in the laboratory, Bernard H. Smith and Harry W. Houghton, who aided in performing the analytical work.

METHODS AND RESULTS OF ANALYSIS.

Since lead, potassium, and barium chromate have all a bright yellow color, and any of them might be used to color the pyrethrum powders, tests for all of these substances were made in the samples under examination according to the following methods:

Qualitative test for lead.—Ash about 2 grams of the sample in porcelain and treat with a little water and about 20 cc of concentrated hydrochloric acid in a porcelain dish. Place on the steam bath and steam for about one-half an hour or until all the lead is in solution and the chromium reduced and in solution. Filter after dilution. Add sodium carbonate until the solution is alkaline and then add acetic acid until the solution is just acid. Filter and add a solution of potassium chromate. A yellow precipitate or cloudiness indicates lead.

Qualitative test for barium.—Ash about 2 grams of the sample in porcelain and treat with hydrochloric acid as directed for lead. Evaporate to dryness and take up with about 0.8 cc of hydrochloric acid. Filter and pass hydrogen sulphid through the filtrate. Filter off any sulphids that may precipitate and test for barium in the filtrate with a few drops of dilute sulphuric acid.

Qualitative test for chromium.—Ash about 2 grams of the sample in porcelain. Treat this with about four times its weight of a mixture of equal parts of sodium carbonate and potassium nitrate, and fuse. Dissolve in water on the steam bath and filter. Make slightly acid with acetic acid and test with lead acetate for the presence of chromium.

Testing the powders by the above methods showed that whenever chromium was present lead was also present, these two evidently being combined as lead chromate. A quantitative estimation was also made of the chromium present according to the following method of analysis and the chromium was calculated to lead chromate.

TABLE 1.—Description of samples, source, and price.

Serial No.	Name.	Retailer.	Manufacturer or wholesaler.	Price per 2 ounces.
266	Persian Insect Powder	G. B. Evans, Philadelphia, Pa.	G. B. Evans, Philadelphia, Pa.	\$0.10
267	Dalmatian Insect Powder	Llewellyn, Philadelphia, Pa.	Llewellyn, Philadelphia, Pa.	.25
268	Insect Powder	Stoecker, Philadelphia, Pa.	Stoecker, Philadelphia, Pa.	.10
269	Pyrethrum	Menages, Madison, Wis.	Menages, Madison, Wis.	.10
270	do	Henry Lewis, Madison, Wis.	Henry Lewis, Madison, Wis.	.05
271	Dalmatian Insect Powder	Hoffister's Pharmacy, Madison, Wis.	Hoffister's Pharmacy, Madison, Wis.	.10
272	Insect Powder	F. L. Gardner, Lansing, Mich.	F. L. Gardner, Lansing, Mich.	.19
273	Dalmatian Insect Powder	Robinson Drug Co., Lansing, Mich.	Robinson Drug Co., Lansing, Mich.	do
274	Spallato Insect Powder	Bauer's Drug Co., Lansing, Mich.	Bauer's Drug Co., Lansing, Mich.	do
275	Bulbadian Insect Powder	M. A. Dickson, Amherst, Mass.	M. A. Dickson, Amherst, Mass.	10
276	Persian Insect Powder	Holland & Gifford, Amherst, Mass.	Holland & Gifford, Amherst, Mass.	.08
277	Dalmatian Insect Powder	H. Adams, Amherst, Mass.	H. Adams, Amherst, Mass.	10
278	do	Charles Deuel, Amherst, Mass.	Charles Deuel, Amherst, Mass.	10
279	Insect Powder	Rector's Pharmacy, Lincoln, Nebr.	Rector's Pharmacy, Lincoln, Nebr.	.15
280	do	Harley Drug Co., Lincoln, Nebr.	Harley Drug Co., Lincoln, Nebr.	.20
281	do	H. W. Brown, Lincoln, Nebr.	H. W. Brown, Lincoln, Nebr.	.05
282	Bulbadi.	do	do	.25
283	Pyrethrum	C. Powells, Stillwater, Okla.	C. Powells, Stillwater, Okla.	.13
312	Insect Powder	W. H. Hand, Stillwater, Okla.	W. H. Hand, Stillwater, Okla.	.10
313	Pyrethrum	Carl Engel, Manhattan, Kans.	Carl Engel, Manhattan, Kans.	.10
314	Insect Powder	Koller & Masters, Manhattan, Kans.	Koller & Masters, Manhattan, Kans.	.05
315	Pyrethrum	G. B. Harrol, Manhattan, Kans.	G. B. Harrol, Manhattan, Kans.	.10
316	do	Orr Drug Co., Athens, Ga.	Orr Drug Co., Athens, Ga.	.15
317	Dalmatian Insect Powder	Pahner & Kinnelohn, Athens, Ga.	Pahner & Kinnelohn, Athens, Ga.	.10
318	do	H. O. Meek, State College, Pa.	H. O. Meek, State College, Pa.	.10
319	Persian Insect Powder	George Martin, Tucson, Ariz.	George Martin, Tucson, Ariz.	.15
323	Bulbadi.	B. L. Read, Bryan, Tex.	B. L. Read, Bryan, Tex.	.05
324	Pyrethrum	do	do	.05
325	do	M. H. James, Bryan, Tex.	M. H. James, Bryan, Tex.	.05
326	do	The Van Deusen Pharmacy, New Brunswick, N. J.	The Van Deusen Pharmacy, New Brunswick, N. J.	.10
327	Persian Insect Powder	William Rust & Sons, New Brunswick, N. J.	William Rust & Sons, New Brunswick, N. J.	.10
328	do	do	do	.10
329	do	William Rust & Sons, New Brunswick, N. J.	William Rust & Sons, New Brunswick, N. J.	.05
330	Insect Powder	L. Christenson, Fargo, N. Dak.	L. Christenson, Fargo, N. Dak.	.10
331	do	R. H. Finney, Fargo, N. Dak.	R. H. Finney, Fargo, N. Dak.	.10
332	do	Font & Fordfield, Fargo, N. Dak.	Font & Fordfield, Fargo, N. Dak.	.10
333	do	B. F. MacCall, Moorhead, Minn.	B. F. MacCall, Moorhead, Minn.	.10
334	do	Walldorf Pharmacy, Fargo, N. Dak.	Walldorf Pharmacy, Fargo, N. Dak.	.05
335	do	G. C. Sudin, Fargo, N. Dak.	G. C. Sudin, Fargo, N. Dak.	.10
336	Pyrethrum	J. E. Knight, Exeter, N. H.	J. E. Knight, Exeter, N. H.	.10
337	do	A. S. Wedderell, Exeter, N. H.	A. S. Wedderell, Exeter, N. H.	.10
338	do	J. C. Vickery, Dover, N. H.	J. C. Vickery, Dover, N. H.	.10
339	Persian Insect Powder	H. E. Glick, Lafayette, Ind.	H. E. Glick, Lafayette, Ind.	.10
340	Pyrethrum	Varotter-Boggs Drug Co., Lafayette, Ind.	Varotter-Boggs Drug Co., Lafayette, Ind.	.05
		Allaire, Woodward & Co., Peoria, Ill.	Allaire, Woodward & Co., Peoria, Ill.	
		Parke, Davis & Co., Detroit, Mich.	Parke, Davis & Co., Detroit, Mich.	
		Lyman Elliot Drug Co., Minneapolis, Minn.	Lyman Elliot Drug Co., Minneapolis, Minn.	
		Noyer Bros. & Cutter, Fargo, N. Dak.	Noyer Bros. & Cutter, Fargo, N. Dak.	
		Parke, Davis & Co., Detroit, Mich.	Parke, Davis & Co., Detroit, Mich.	
		Smith, Kline & French, Philadelphia, Pa.	Smith, Kline & French, Philadelphia, Pa.	
		Rubach Manufacturing Co., Stockton, Cal.	Rubach Manufacturing Co., Stockton, Cal.	
		Parke, Davis & Co., Detroit, Mich.	Parke, Davis & Co., Detroit, Mich.	
		Finer & Amend, New York, N. Y.	Finer & Amend, New York, N. Y.	
		Nickells Stone-Chemical Co., New Orleans, La.	Nickells Stone-Chemical Co., New Orleans, La.	
		Richardson Drug Co., Stockton, Cal.	Richardson Drug Co., Stockton, Cal.	
		do	do	
		Schuffelein & Co., (wholesaler) New York, N. Y.	Schuffelein & Co., (wholesaler) New York, N. Y.	
		E. L. Patch Co. (wholesaler) Boston, Mass.	E. L. Patch Co. (wholesaler) Boston, Mass.	
		Lee & Osgood, Norwich, Conn.	Lee & Osgood, Norwich, Conn.	
		Hoyt-McGee Co., New York, N. Y.	Hoyt-McGee Co., New York, N. Y.	
		Archibald & Lewis, New York, N. Y.	Archibald & Lewis, New York, N. Y.	
		Lehm & Fink, New York, N. Y.	Lehm & Fink, New York, N. Y.	
		do	do	
		Parke, Davis & Co., Detroit, Mich.	Parke, Davis & Co., Detroit, Mich.	
		Faxon, Horton & Gallagher, Kansas City, Mo.	Faxon, Horton & Gallagher, Kansas City, Mo.	
		Gilpin, Langdon & Co., Baltimore, Md.	Gilpin, Langdon & Co., Baltimore, Md.	

341	do.	Hogan-Johnson Drug Co., Lafayette, Ind.	Stollman & Fulton, New York, N. Y.	.05
381	Palmarian Insect Powder.	D. B. Sloan, Clemson College, S. C.	F. H. Leggett, New York, N. Y.	.15
385	do.	E. G. Evans, Jr., & Co., Pendleton, S. C.	Parke, Davis & Co., Detroit, Mich.	.10
386	Persian Insect Powder.	R. D. Stearns, Burlington, Vt.	Schlotfeldt & Co., New York, N. Y.	.10
387	do.	C. A. Barber, Burlington, Vt.	J. E. Gary & Co., Boston, Mass.	.10
388	do.	G. A. Churchhill, Burlington, Vt.	McKesson & Robbins, New York, N. Y.	.10
389	do.	G. E. Perkins, Burlington, Vt.	Burlington Drug Co., Burlington, Vt.	.10
390	do.	J. E. Bellows, Burlington, Vt.	Polk & Golder, Troy, N. Y.	.10
391	do.	Crystal Pharmacy, Burlington, Vt.	Parke, Davis & Co., Detroit, Mich.	.10
392	Insect Powder.	Prictor & O'Hall, Wooster, Ohio.		
393	do.	Zimmerman & Co., Wooster, Ohio.	Allaire, Woodward & Co., Peoria, Ill.	
394	do.	Suback & Boyd, Wooster, Ohio.	Bulach Manufacturing Co., Stockton, Cal.	.05
395	Bulach.	Graham & Wortham, Corvallis, Oreg.		
396	Persian Insect Powder.	Graham & Wells, Corvallis, Oreg.	Bhmalcer, Frank & Co., Portland, Oreg.	.05
397	do.	Allen & Woodward, Corvallis, Oreg.	Lehn & Funk, New York, N. Y.	.10
401	Palmarian Insect Powder.		Parke, Davis & Co., Detroit, Mich.	.05
402	Pyrethrum.	Owens & Owens, Wytheville, Va.	do.	.15
403	Persian Insect Powder.	Ellitt's Drug Store, Blacksburg, Va.	Nathan Howe, Boston, Mass.	
404	Black Flag Insect Powder.	Owens & Owens, Wytheville, Va.	Leggett Bros., New York, N. Y.	
419	Pyrethrum.	White & Burdick, Ithaca, N. Y.	B. Ritchey & Co., New York, N. Y.	.10
420	do.	Brooks's Drug Store, Ithaca, N. Y.		.10
421	Insect Powder.	P. Simmon, Danbury, Conn.		.10
422	Persian Insect Powder.	A. Dutschkeyer, Hartford, Conn.		.10
423	Insect Powder.	E. D. Weed, Norwalk, Conn.		.10
424	do.	J. M. Colter & Co., New Britain, Conn.		.05
425	do.	Park Drug Co., Hartford, Conn.		.10
426	do.	C. H. Belle, Hartford, Conn.		.10
427	Palmarian Insect Powder.	C. L. Finch, Norwalk, Conn.		.20
428	Insect Powder.	G. S. Colburn, New Haven, Conn.		.10
429	do.	G. R. Steele, Thompsonville, Conn.		.05
430	do.	Hull's Drug Store, New Haven, Conn.		.10
431	do.	Hardigan Pharmacy, Bridgeport, Conn.		.05
432	do.	Waterbury Drug Co., Waterbury, Conn.		.05
433	do.	J. A. McMillan & Co., Knoxville, Tenn.	Sanford, Chamberlain & Albers, Knoxville, Tenn.	.10
434	do.	W. W. Ball, Knoxville, Tenn.	McKesson & Robbins, New York, N. Y.	.20
435	do.	H. Kuhlman, Knoxville, Tenn.		.10
436	do.	The Laramie Drug Co., Laramie, Wyo.	Bulach Manufacturing Co., Stockton, Cal.	.10
437	do.	do.		.20
438	do.	Ticknor & Jagger, St. Paul, Minn.		.10
439	do.	M. L. Payant, Fairbault, Minn.	Allaire, Woodward & Co., Peoria, Ill.	.10
440	do.	Pilling Drug Co., Minneapolis, Minn.	Fuller & Fuller, Chicago, Ill.	.10
441	do.	J. T. Tidball, Brookings, S. Dak.	Parke, Davis & Co., Detroit, Mich.	.10
442	do.	do.	do.	.10
443	do.	Irwin Pharmacy, Brookings, S. Dak.		.10
444	do.	Johnson-Platt Drug Co., Salt Lake City, Utah.	Bulach Manufacturing Co., Stockton, Cal.	.10
445	do.	Willis-Horne Drug Co., Salt Lake City, Utah.	Allaire, Woodward & Co., Peoria, Ill.	.10
446	do.	J. L. Argenti, San Francisco, Cal.	California Insect Powder Co., Stockton, Cal.	.10
447	do.	Wm. Seaply, San Francisco, Cal.	Thurston & Bradish, New York, N. Y.	.10
448	do.	Langley & Michaels, San Francisco, Cal.	Bulach Manufacturing Co., Stockton, Cal.	.10
449	do.	do.		.20
450	do.	C. T. Carr & Bro., Hyattsville, Md.		
451	do.	Thomson & Hogan, Christiansburg, Va.	Parke, Davis & Co., Detroit, Mich.	
452	do.			
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616	do.			
617	do.			

TABLE 1.—*Description of samples, source, and price—Continued.*

Serial No.	Name.	Retailer.	Manufacturer or wholesaler.	Price per 2 ounces.
648	Insect powder.....	R. S. Carson, East Bradford, Va.....	Parks, Davis & Co., Detroit, Mich.....	.....
649	Persian Insect Powder.....	G. W. Lyle, Bradford, Va.....	do.....	\$0.24
653	Buhach.....	C. L. McCartor, Moscow, Idaho.....	Buhach Manufacturing Co., Stockton, Cal.....	.15
694	Insect Powder.....	L. H. Torsen, Moscow, Idaho.....	Parke, Davis & Co., Detroit, Mich.....	.10
695	Persian Insect Powder.....	A. K. Greenman, Kingston, R. I.....	Brownell & Field, Providence, R. I.....	.10
696	do.....	.....	Oliver Johnson & Co., Providence, R. I.....	.10
697	Insect Powder.....	.....	Austin, Nichols & Co., New York, N. Y.....	.15
698	Castilian Insect Powder.....	.....	.....	.10
a 19539	Persian Insect Powder.....	Z. D. Gilman, Washington, D. C.....	Z. D. Gilman, Washington, D. C.....	.10

a General index number.

Method for determining chromic acid.—Weigh out from 2 to 4 grams of the sample. Ash in a porcelain dish and allow to cool. Treat with a little water and a large amount of concentrated hydrochloric acid and evaporate to dryness. Treat again with concentrated hydrochloric acid and evaporate to dryness.

Take up the residue with about 0.8 cc of concentrated hydrochloric acid with the aid of heat. Filter and pass hydrogen sulphid through the solution until all lead is precipitated. Filter and evaporate the filtrate to dryness. Take up the residue with a little water and 1 cc of hydrochloric acid with the aid of heat. Precipitate out the chromium (with iron, aluminum, and some phosphoric acid) by means of ammonia, taking care not to add any excess of ammonia. Filter and wash with hot water. Dissolve the precipitate on the filter by means of hot dilute hydrochloric acid and evaporate to dryness. Take up with a little hot water and 6 to 8 drops of concentrated hydrochloric acid, heating for a short time if necessary. Transfer to a 50 cc or 100 cc flask and make up to the mark. Now prepare an alkaline permanganate solution in the following manner: Make an approximately N 10 solution of potassium permanganate and standardize it against ammonium ferrous sulphate. Measure out exactly a liter of this solution and add a few grams of sodium carbonate and 1 gram of sodium hydroxid and make the entire volume up to 2 liters. This is the standard solution required.

A convenient number of cubic centimeters of this standard is measured into a beaker and about 50 cc of distilled water, accompanied by a little sodium carbonate, is added. The solution of chromium previously prepared is then run in from a burette, while the contents of the beaker are boiling, until the pink color is dissipated and a pure yellow color results. Knowing the strength of the permanganate and the number of cubic centimeters of the chromium solution used, one can calculate the percentage of chromium in the original powder according to the following equation:



In Table II are found the results obtained upon the samples of pyrethrum powder examined:

TABLE II.—*Examination of pyrethrum powders for coloring matter.*^a

Serial No.	Name.	Chromium.	Lead.	Chromium trioxid (CrO ₃).	Lead chromate (PbCrO ₄).
				<i>Per cent.</i>	<i>Per cent.</i>
266	Persian Insect Powder	Absent ...	Absent ...		
267	Dalmatian Insect Powder.....	Present ...	Present ...	0.099	0.32
268	Insect Powder	do	do .....	.071	.23
269	Pyrethrum	Absent ...	Absent ...		
270	do	do	do		
271	Dalmatian Insect Powder.....	do	do		
272	Insect Powder	do	do		

^a Examination for barium gave negative results for all samples.

TABLE II.—*Examination of pyrethrum powders for coloring matter—Continued.*

Serial No.	Name.	Chromium.	Lead.	Chromium trioxid (CrO ₃).	Lead chromate (PbCrO ₄).
				<i>Per cent.</i>	<i>Per cent.</i>
a 273	Dalmatian Insect Powder	Present...	Present...	.068	.22
274	Spalato Insect Powder	Absent...	Absent...		
275	Dalmatian Insect Powder	Present...	Present...	.130	.42
276	Persian Insect Powder	Absent...	Absent...		
277	Dalmatian Insect Powder	Present...	Present...	.068	.22
278	.....do.....	Absent...	Absent...		
279	Insect Powder .....	.....do.....	.....do.....		
280	.....do.....	.....do.....	.....do.....		
281	.....do.....	.....do.....	.....do.....		
282	Buhach .....	.....do.....	.....do.....		
283	Pyrethrum .....	.....do.....	.....do.....		
312	Insect Powder .....	.....do.....	.....do.....		
313	Pyrethrum .....	.....do.....	.....do.....		
314	Insect Powder .....	.....do.....	.....do.....		
315	Pyrethrum	Present...	Present...	.124	.40
316	.....do.....	.....do.....	.....do.....	.102	.33
317	Dalmatian Insect Powder	Absent...	Absent...		
318	.....do.....	.....do.....	.....do.....		
a 319	Persian Insect Powder	Present...	Present...	.186	.60
323	Buhach	Absent...	Absent...		
324	Pyrethrum .....	.....do.....	.....do.....		
325	.....do.....	.....do.....	.....do.....		
326	.....do.....	Present...	Present...	.251	.81
327	Persian Insect Powder .....	.....do.....	.....do.....	.365	1.18
328	.....do.....	Absent...	Absent...		
329	.....do.....	Present...	Present...	.421	1.36
330	Insect Powder	Absent...	Absent...		
331	.....do.....	.....do.....	.....do.....		
332	.....do.....	.....do.....	.....do.....		
333	.....do.....	.....do.....	.....do.....		
334	.....do.....	.....do.....	.....do.....		
335	.....do.....	.....do.....	.....do.....		
336	Pyrethrum .....	.....do.....	.....do.....		
337	.....do.....	.....do.....	.....do.....		
338	.....do.....	.....do.....	.....do.....		
339	Persian Insect Powder .....	.....do.....	.....do.....		
a 340	Pyrethrum	Present...	Present...	.090	.29
341	.....do.....	Absent...	Absent...		
384	Dalmatian Insect Powder .....	.....do.....	.....do.....		
385	.....do.....	.....do.....	.....do.....		
a 386	Persian Insect Powder	Present...	Present...	.043	.14
387	Insect Powder	Absent...	Absent...		
388	Persian Insect Powder .....	.....do.....	.....do.....		
389	.....do.....	.....do.....	.....do.....		
390	.....do.....	.....do.....	.....do.....		
391	.....do.....	.....do.....	.....do.....		
392	Insect Powder .....	.....do.....	.....do.....		
393	.....do.....	.....do.....	.....do.....		
394	.....do.....	.....do.....	.....do.....		
395	Buhach .....	.....do.....	.....do.....		
396	Persian Insect Powder .....	.....do.....	.....do.....		
397	.....do.....	.....do.....	.....do.....		
401	Dalmatian Insect Powder .....	.....do.....	.....do.....		
402	Pyrethrum .....	.....do.....	.....do.....		
403	Persian Insect Powder .....	.....do.....	.....do.....		
404	Black Flag Insect Powder .....	.....do.....	.....do.....		
419	Pyrethrum	Present...	Present...	.037	.12
420	.....do.....	.....do.....	.....do.....	.056	.18
421	Insect Powder	Absent...	Absent...		
422	Persian Insect Powder .....	.....do.....	.....do.....		
423	Insect Powder	Present...	Present...	.186	.60
424	.....do.....	Absent...	Absent...		
425	.....do.....	.....do.....	.....do.....		
426	.....do.....	.....do.....	.....do.....		
427	Dalmatian Insect Powder	Present...	Present...	.362	1.17
428	Insect Powder	Absent...	Absent...		
429	.....do.....	.....do.....	.....do.....		
430	.....do.....	.....do.....	.....do.....		
431	.....do.....	.....do.....	.....do.....		
432	.....do.....	.....do.....	.....do.....		
433	.....do.....	.....do.....	.....do.....		
434	.....do.....	.....do.....	.....do.....		
435	.....do.....	.....do.....	.....do.....		
492	Dalmatian Insect Powder .....	.....do.....	.....do.....		
493	Buhach .....	.....do.....	.....do.....		
494	Pyrethrum .....	.....do.....	.....do.....		
495	Insect Powder .....	.....do.....	.....do.....		

a See correspondence with manufacturers, p. 20.

TABLE II.—*Examination of pyrethrum powders for coloring matter*—Continued.

Serial No.	Name.	Chromium.	Lead.	Chromium trioxid (CrO ₃).	Lead chromate (PbCrO ₄).
				<i>Per cent.</i>	<i>Per cent.</i>
496	Insect powder.....	Absent...	Absent...		
509	Pyrethrum.....	Present...	Present...	.046	.15
510	Persian Insect Powder.....	Absent...	Absent...		
511	Pyrethrum.....	do	do		
512	Dalmatian Insect Powder.....	do	do		
513	Buhach.....	do	do		
591	do.....	do	do		
592	do.....	do	do		
593	Persian Insect Powder.....	do	do		
594	Buhach.....	do	do		
642	Pyrethrum.....	do	do		
647	Insect Powder.....	do	do		
648	do.....	do	do		
649	Persian Insect Powder.....	do	do		
693	Buhach.....	do	do		
694	Insect Powder.....	do	do		
695	Persian Insect Powder.....	do	do		
696	do.....	do	do		
697	Insect Powder.....	do	do		
α 19530	Persian Insect Powder.....	Present...	Present...	.455	1.47

αGeneral index number.

A glance at this table shows that wherever the powders are colored by a foreign substance lead chromate is the compound used. Nineteen of the 105 samples, or 18 per cent, were colored by lead chromate, the amount of which varied from 0.12 to 1.47 per cent.

Of the adulterated samples, 5 were sold under the name of Dalmatian Insect Powder, 5 under the name of Persian Insect Powder, 7 under the name of pyrethrum, and 2 simply as insect powder. It is also evident from Tables I and II that some firms are sending out two grades of pyrethrum, one containing lead chromate and the other not containing that substance. It is unfortunate that the names of all those who originally prepared the above samples could not be obtained since the powders containing the largest amount of lead chromate lack the name of the manufacturer with surprising regularity.

It seems hardly necessary to call attention to the widespread harm that is undoubtedly caused by powders thus colored. They are sold in all parts of the country and are especially advocated to kill or drive away flies, fleas, cockroaches, and other household pests, and thus they are used principally in the home. Consequently they are breathed by many people for days and weeks at a time. Such powders not only possess the poisonous characteristics of nearly all lead salts, but in addition have the toxic properties of chromic acid. It would appear, therefore, that the influence of lead chromate day by day no doubt occasions many of the mysterious cases of lead poisoning in which it seems impossible for the physician to find the source of the lead taken into the system.

CORRESPONDENCE WITH MANUFACTURERS.

In order that the manufacturers might have an opportunity to comment upon the analyses before they were published, a circular letter

was sent to each one whose goods had been examined, giving him the results of our analysis and asking for any comments that he might desire to make. Such parts of the answers as throw any light upon the subject are given, as follows:

Serial No. 340.

* * * You say that the Varoter-Boggs Drug Company, of Lafayette, Ind., furnished you with a sample of our insect powder containing 0.29 per cent of lead chromate. If such is the case, they added the lead chromate themselves, as we do not use it. We do not color our insect powder, but leave that for the customers to do if their trade demands a highly colored powder.

ALLAIRE, WOODWARD & Co.

Comment: It appears that the above sample was probably colored after it left the hands of the manufacturer, since seven other samples of Allaire, Woodward & Co.'s goods (Nos. 269, 271, 280, 281, 394, 496, and 591) contained no lead chromate.

Serial No. 273.

* * * From the manager of our importing department we also receive the positive assurance that the powder entering into your sample No. 273 could not possibly have contained lead chromate as it left the hands of his department. It goes without saying that we never add lead chromate or any other foreign substance to our insect powder and that the adulteration which you report must have been deliberately put into it by some interested person after it passed out of our possession.

PARKE, DAVIS & Co.

Comment: It appears from investigations which have been made that the above sample received the lead chromate after it left the hands of the manufacturer named, if indeed it were manufactured by the firm originally. Fourteen other samples of Parke, Davis & Co.'s goods (Nos. 272, 313, 331, 334, 385, 391, 402, 403, 510, 511, 647, 648, 649, 694) contained no lead chromate.

Serial No. 386.

* * * Messrs. R. D. Stearns & Co., Burlington, Vt., are in error as to the source of the Persian insect powder which they furnished your representative, stating that it came from our firm, and we have written them to that effect and asked for an explanation. We have examined their entire account for the year 1902, and positively state that they did not purchase any insect powder of us, and if they had it would have been found to be perfectly pure, as we do not allow any adulteration of Persian powder sold by us.

SCHIEFFELIN & Co.

Comment: It is probable that the retailer made a mistake in giving the source of his insect powder, since another sample furnished by Schieffelin & Co. (No. 279) contained no lead chromate.

Serial No. 319.

* * * We presume that this analysis is approximately correct, and that therefore there is foreign matter in the insect powder amounting to a little over one-half of 1 per cent. This additional matter is undoubtedly added, not for the purpose of adul-

teration, but for the purpose of brightening the color of the goods. * * * Until recent years it was the custom to sell only colored insect powder, which, of course, required the addition of a considerable percentage of coloring matter. Some years ago, however, we and some others decided that we would endeavor to educate the trade to accept only a strictly pure insect powder, uncolored, and we now supply the colored only, we believe, to one customer, who insists on getting the same. * * * The particular lot of which you sent us the test, however, is not of our own powdering. Last year there was a sudden and very large advance in the price of insect flowers, and we therefore bought in this country the insect powder of a brand that has been held to be one of the most reliable and has had an established reputation for over fifty years. The exceedingly small amount of foreign matter added, amounting to a little over 0.5 per cent, proves conclusively that the object was not to adulterate the powder.

SMITH, KLINE & FRENCH Co.

II. A COMPILATION OF ANALYSES OF INSECTICIDES AND FUNGICIDES.^a

INTRODUCTION.

In a recent publication^b of the Bureau of Chemistry analyses of all the insecticides and fungicides that could be obtained on the American market were given, together with such remarks concerning their effectiveness as the results seemed to justify. It was originally intended that all of the analyses which had previously been made by the various experiment stations should be included in that bulletin. By reason, however, of unavoidable delays, two years passed between the time of collecting the samples and the time of completing the analyses. Since results of this kind, to be of the most value, should be published at once, it was thought desirable to reserve the compilation of results obtained in the various States for a future publication. This article therefore includes a compilation of analyses of insecticides and fungicides made by the various experiment stations, together with a few analyses made by the Bureau of Chemistry since the publication of Bulletin 68.

The insecticides are arranged in groups, as in the previous bulletin, with the addition of two or three classes not taken up in that publication, and the omission of a few classes not examined by the experiment stations. They will be considered in the following order: (1) Paris greens; (2) London purples; (3) insecticides and fungicides, other than Paris greens and London purples, that contain arsenic, copper, or both; (4) soaps; (5) lyes; (6) hellebores; (7) mixtures containing borax; (8) tobacco extracts; (9) formalins; (10) petroleums; (11) miscellaneous solid insecticides and fungicides, and (12) miscellaneous liquid insecticides and fungicides.

SOURCES OF ANALYSES AND DESCRIPTION OF SAMPLES.

Table I, on the following pages, is introduced to show the publications from which the analyses were taken and, when possible, the names of the manufacturers of the various compounds.

^a No responsibility is assumed by the Department for the correctness of compiled analyses, not made within the Department itself.

^b U. S. Dept. Agr., Bureau of Chemistry Bul. 68, The Chemical Composition of Insecticides and Fungicides.

TABLE I.—*Source of analysis and description of samples.*

Sample No.	Name.	Source.	Manufacturer of sample.
1	Paris Green	Alabama Experiment Station, Bulletin No. 58 (1894).	Elmer & Amend, New York City.
2	do	do	
3	do	do	
4	do	do	
5	do	do	
6	do	do	
7	do	do	
8	do	California Experiment Station Report (1891), p. 79.	
9	do	do	
10	do	do	
11	do	do	Green Bark Alkali Works Co., Lancashire, England. Do. Langley & Michaels, San Francisco, Cal. In New York City.
12	do	do	
13	do	do	
14	do	California Experiment Station Report (1895), p. 137.	
15	Philadelphia Solid Lye	do	
16	American Concentrated Lye	California Experiment Station, Bulletin No. 52.	
17	Double Concentrated 98 percent Caustic Soda.	do	
18	Refined Pearl Ashes.	do	
19	Commercial Potash	do	
20	Canadian Crude Potash	do	
21	Paris Green	California Experiment Station, Bulletin No. 126.	B. T. Babbitt. American Lye Co., Philadelphia.
22	do	do	
23	do	do	
24	do	do	
25	do	do	
26	do	do	
27	White Arsenoid	do	
28	Pink Arsenoid.	do	
29	Green Arsenoid.	do	
30	Paragrene	do	
31	Paris Green	Florida Experiment Station, Bulletin No. 14 (July 1, 1891).	B. T. Babbitt. American Lye Co., Philadelphia.
32	Concentrated Lye (Potash)	Idaho Agricultural Experiment Station, Bulletin No. 19 (1899).	
33	American Lye.	do	
34	Paris Green (average of 7)	do	
35	Sulphur	do	
36	do	do	
37	Paris Green	Idaho Agricultural Experiment Station, Bulletin No. 25 (1901).	
38	do	do	
39	do	do	
40	do	do	
41	do	do	
42	do	do	
43	do	do	

44	do	do	
45	do	do	
46	do	do	
47	do	do	
48	do	do	
49	do	do	
50	do	do	
51	do	do	
52	do	do	
53	do	do	
54	do	do	
55	do	do	
56	do	do	
57	Paris Green (Lion brand, new process)	Not published, but kindly forwarded by Illinois Agricultural Experiment Station.	A. B. Ausbacher & Co., New York City.
58	Partridge	do	J. A. Blanchard, New York City.
59	Paris Green	do	E. L. Lavanburg, New York City.
60	do	do	
61	do	do	
62	do	do	
63	do	do	
64	do	do	
65	Formalin (average of 5)	Indiana Experiment Station Report (1899).	H. K. Mulford Co., Chicago, Ill.
66	do	Indiana Experiment Station Report (1900).	A. B. Ausbacher & Co., New York City.
67	do	do	Fuller & Fuller, Chicago, Ill.
68	do	do	
69	Paris Green (average of 10)	Louisiana Experiment Station, Bulletin No. 1, second series (1896), p. 25.	Henry Heil & Co.
70	Paris Green	Louisiana Experiment Station, Bulletin No. 23, second series (1897), pp. 778-782.	Hogan & Johnson
71	Paris Green (average of 2)	Louisiana Experiment Station, Bulletin No. 39, second series (1895), pp. 1431-1434.	Edmer & Amend, New York City.
72	Paris Green (average of 8)	Louisiana Experiment Station, Bulletin No. 45, second series (1896), pp. 80-84.	
73	Pine Tar Insecticide	Louisiana Experiment Station, Bulletin No. 48, second series (1897).	Sondheim, Alsborg & Co., New York City.
74	Paris Green (average of 39)	Louisiana Experiment Station, Bulletin No. 49, second series (1897), pp. 198-201.	
75	do	Louisiana Experiment Station, Bulletin No. 51, second series (1898).	
76	Paris Green (average of 36)	Louisiana Experiment Station, Bulletin No. 58, second series (1899).	
77	Paris Green (average of 149)	Louisiana Experiment Station, Bulletin No. 63, second series (1900).	
78	Paris Green (average of 79)	do	
79	Paris Green (average of 35)	do	
80	Paris Green (average of 19)	Hatch Experiment Station, Massachusetts, Bulletin No. 28 (1896).	
81	Paris Green	do	
82	do	do	
83	do	do	
84	do	do	
85	do	do	

TABLE I.—*Source of analysis and description of samples*—Continued.

Sample No.	Name.	Source.	Manufacturer of sample.
85	Paris Green (Lion brand, new process)	Hatch Experiment Station, Massachusetts, Bulletin No. 38 (1896).	James Blanchard, New York City.
86	do	do	do.
87	do	do	do.
88	do	Hatch Experiment Station, Massachusetts, Bulletin No. 74 (1901).	Adler Color and Chemical Works, New York City.
89	Pink Arsenoid	do	do.
90	Green Arsenoid	do	do.
91	White Arsenoid	do	Nichols Chemical Co., Syracuse, N. Y.
92	Laurel Green	do	Dunforth Chemical Co., Leominster, Mass.
93	Bug Death	do	I. Pfeiffer, New York City.
94	Paris Green	do	A. B. Anslacher, New York City.
95	do	do	Alsborg & Pfeiffer, New York City.
96	do	do	Hampden Paint and Chemical Co., Springfield, Mass.
97	do	do	Cawley Clark & Co., Newark, N. J.
98	do	do	J. A. Blanchard, New York City.
99	Paris Green (Lion brand)	do	do.
100	do	do	A. B. Anslacher, New York City.
101	Paris Green	do	Leggett & Bro., New York City.
102	do	do	E. & F. King Company, Boston, Mass.
103	do	do	C. T. Reynolds & Co., New York City.
104	do	do	J. A. Blanchard, New York City.
105	Paris Green (Lion brand, new process)	do	do.
106	Paris Green	do	E. & F. King Co., Boston, Mass.
107	do	do	C. T. Reynolds & Co., New York City.
108	do	Hatch Experiment Station, Massachusetts, Bulletin No. 81 (1902).	J. A. Blanchard, New York City.
109	Paris Green (composite of 3)	do	E. & F. King Co., Boston, Mass.
110	Paris Green	do	C. T. Reynolds & Co., New York City.
111	Paris Green (composite of 2)	do	I. Pfeiffer, New York City.
112	Paris Green	do	J. A. Blanchard, New York City.
113	do	do	C. N. Childs & Co., New York City.
114	do	do	Leggett & Bro., New York City.
115	do	do	A. B. Anslacher & Co., New York City.
116	Tobacco Liquor	Massachusetts State Experiment Station Report (1890), pp. 275-276.	do.
117	do	do	do.
118	Paris Green	do	do.
119	do	do	do.
120	Sulphathine	do	do.
121	Death to Rose Bugs	do	do.
122	Prof. De Graff's Bug Destroyer	Massachusetts State Experiment Station Report (1892), p. 336.	do.
123	Paris Green	do	do.
124	do	do	do.
125	do	do	do.

126	do	do	Leggett & Co., New York City.
127	do	do	A. J. Peck, Meridian, Miss.
128	do	do	Mausfield Drug Co., Memphis, Tenn.
129	Perfect Bug Destroyer	do	I. L. Lyons, New Orleans, La.
130	Tobacco Liquor	do	John Lucas & Co., New York City.
131	do	do	Acme Color Works, New York City.
132	Nicotina	do	A. B. Ansbacher & Co., New York City.
133	Helicbore	do	F. W. Devoe & Co., New York City.
134	do	do	C. T. Reynolds & Co., New York City.
135	Peroxide of Silicates	do	do.
136	Orical Fertilizer and Bug Destroyer	Massachusetts State Experiment Station Report (1893), p. 324.	
137	Nonpoisonous Potato Bug Destroyer	do	
138	Paris Green	Mississippi Experiment Station Report (1891), p. 36.	
139	do	do	
140	do	do	
141	do	do	
142	do	do	
143	do	do	
144	do	do	
145	do	do	
146	do	do	
147	do	do	
148	London Purple	do	
149	do	do	
150	Orical Fertilizer and Insect Destroyer	New Hampshire Experiment Station Report (1894), pp. 121-122.	
151	Nonpoisonous Insect Exterminator	do	
152	Paris Green (average of 5)	New Hampshire Experiment Station, Bulletin No. 36 (1896).	
153	London Purple	do	
154	Helicbore	do	
155	do	do	
156	do	do	
157	do	do	
158	do	do	
159	Paris Green	New Hampshire Experiment Station, Bulletin No. 43.	
160	do	New Jersey Experiment Station Report (1897), pp. 397-492.	
161	do	do	
162	do	do	
163	do	do	
164	do	do	
165	do	do	
166	do	do	
167	do	do	
168	Paris Green (Lion brand)	do	
169	Paris Green (New Process)	do	
170	Paris Green	do	
171	Potash Whale-Oil Soap	do	
172	Whale-Oil Soap	do	
173	do	do	
174	Whale-Oil Soap (Anchor brand)	do	

Leggett & Co., New York City.
A. J. Peck, Meridian, Miss.
Mausfield Drug Co., Memphis, Tenn.
I. L. Lyons, New Orleans, La.
John Lucas & Co., New York City.
Acme Color Works, New York City.
A. B. Ansbacher & Co., New York City.
F. W. Devoe & Co., New York City.
C. T. Reynolds & Co., New York City.
do.

Hemingway's London Purple Co., London, England.
West & Jeremy, Boston, Mass.
Leggett & Bros., New York City.

Wetherell & Co.

John Lucas & Co., New York City.

Cawley, Clark & Co., Newark, N. J.
C. T. Reynolds & Co., New York City.
Cawley, Clark & Co., Newark, N. J.
Robert Shoemaker,
John Lucas & Co., New York City.
J. A. Blanchard, New York City.
do.

Leggett & Bros., New York City.
Good's
Richardson formula.
A. Pfeiffer,
Leggett & Bros., New York City.

TABLE I.—*Source of analysis and description of samples—Continued.*

Sample No.	Name.	Source.	Manufacturer of sample.
175	London Purple.....	New Jersey Experiment Station Report (1890), p. 523..	
176	X. O. Dust.....	do.....	
177	Paris Green (average of 5)	New York Cornell Experiment Station, Bulletin No. 149 (1898).	
178	English Purple.....	do.....	
179	Paris Purple.....	do.....	
180	do.....	do.....	
181	Slug Shot.....	do.....	
182	Laurel Green.....	do.....	
183	Bug Death.....	do.....	
184	Paris Green.....	New York Cornell Experiment Station, Bulletin No. 177 (1900).	
185	Paragrene.....	do.....	
186	Green Arsenite.....	do.....	
187	XX.....	do.....	
188	Pink Arsenoid.....	do.....	
189	Green Arsenoid.....	do.....	
190	Green Arsenoid (No. 53).....	do.....	
191	Special Laurel Green.....	do.....	
192	Paris Green (average of 24)	New York State Experiment Station, Bulletin No. 165 (1899).	
193	Paragrene.....	do.....	
194	do.....	do.....	
195	London Purple.....	do.....	
196	Laurel Green.....	do.....	
197	Electric Vermin Exterminator.....	do.....	
198	Paris Green.....	New York State Experiment Station, Bulletin No. 190 (1900).	Acme Color Works.
199	do.....	do.....	do.
200	do.....	do.....	Adler Color and Chemical Works.
201	do.....	do.....	do.
202	do.....	do.....	A. B. Ainsbacher & Co.
203	do.....	do.....	do.
204	do.....	do.....	J. A. Blanchard.
205	do.....	do.....	do.
206	do.....	do.....	Cawley, Clark & Co.
207	do.....	do.....	C. M. Childs & Co.
208	do.....	do.....	Eckstein Bros.
209	do.....	do.....	M. Hermann & Co.
210	do.....	do.....	Highlands Chemical Co.
211	do.....	do.....	F. L. Lavanburg.
212	do.....	do.....	Leggett & Bros.
213	do.....	do.....	New York Enamel Paint Co.
214	do.....	do.....	John C. Lucas.
215	do.....	do.....	I. Pfeiffer.

216	do	do	C. T. Reynolds & Co.
217	do	do	do.
218	do	do	do.
219	do	do	
220	Green Asenoid	do	
221	Paragrene	do	
222	Black Death	do	
223	Bug Death	do	
224	Bug Shot	do	
225	Paris Green	New York State Experiment Station, Bulletin No. 201 (1901).	
226	do	do	do.
227	do	do	Adler Color and Chemical Works.
228	do	do	do.
229	do	do	A. B. Anshacher & Co.
230	do	do	do.
231	do	do	J. A. Blanchard.
232	do	do	do.
233	do	do	do.
234	do	do	G. C. Buel & Co.
235	do	do	Cowley, Clark & Co.
236	do	do	C. M. Childs & Co.
237	do	do	do.
238	do	do	Hampden Paint Co.
239	do	do	Morris Hermann & Co.
240	do	do	do.
241	do	do	do.
242	do	do	Fred. L. Lavinburg.
243	do	do	do.
244	do	do	do.
245	do	do	do.
246	do	do	G. O. E. Lavenack.
247	do	do	Leggett & Bros.
248	do	do	do.
249	do	do	do.
250	do	do	New York Enamel Paint Co.
251	do	do	do.
252	do	do	do.
253	do	do	I. Pfeiffer.
254	do	do	do.
255	do	do	do.
256	do	do	do.
257	do	do	C. T. Reynolds & Co.
258	do	do	Dexco, Reynolds & Co.
259	do	do	Solomon & Schwartz.
260	do	do	Sondheim, Alsbury & Co.
261	do	do	Stanley, Jordan & Co.
262	do	do	John L. Thompson Sons.
263	do	do	
264	do	do	
265	English Bug Compound	do	English Compound Co.
266	Emerald Green	do	Nichols Chemical Co.
267	do	do	do.

Benj. Hammond, Fishkill on the Hudson, N. Y.
Acme Color Works.

TABLE I.—*Source of analysis and description of samples*—Continued.

Sample No.	Name.	Source.	Manufacturer of sample.
268	London Purple.....	New York State Experiment Station Bulletin No. 904 (1901).	Hemingway's London Purple Co.
269	Paragrene.....	do	F. L. Lavanburg.
270	Paris Green, Bordeaux Mixture.....	do	Loggett & Bros.
271	Disparane.....	Ohio Experiment Station, Bulletin No. 127 (1901)	Bowker Chemical Co., Boston, Mass.
272	Arsenate of Lead.....	do	Swift & Co., Boston, Mass.
273	Paris Green.....	do	Laubach & Boyd, Wooster, Ohio.
274	do.....	do	
275	Crude Petroleum.....	do	
276	do.....	do	
277	do.....	do	
278	do.....	do	
279	Paris Green (average of 18).....	Oregon Experiment Station, Bulletin No. 49 (1898)	
280	Postite.....	Pennsylvania Experiment Station Report (1892), p. 138.	
281	Par' goldum.....	do	
282	Antimonium.....	do	
283	Paris Green.....	South Carolina Experiment Station Report (1888), p. 142.	
284	London Purple.....	do	
285	Paris Green.....	Not published; kindly furnished by South Carolina Experiment Station.	
286	do.....	Vermont Experiment Station Report (1888)	C. T. Reynolds & Co., New York City.
287	London Purple.....	do	Hemingway's London Purple Co., London, England.
288	Paris Purple.....	do	A. Poirrier, Paris, France.
289	Peroxid of Silicates.....	do	Peroxid of Silicate Co., New York City.
290	Slug Shot.....	do	Hammond's, Fishkill on the Hudson, N. Y.
291	Paris Green.....	Washington Experiment Station Report (1896) pp. 45-56.	
292	Arsenate of Lead.....	Not published; data furnished by H. H. Harrington, Texas Agricultural Experiment Station.	F. L. Lavanburg, New York City.
293	do.....	do	do
294	do.....	do	Merrimac Chemical Co., Boston, Mass.
295	do.....	do	do
296	do.....	do	Do. Worsham Drug Co., Dallas, Tex.
297	Paris Green.....	do	Adler Color and Chemical Co., New York City.
298	do.....	do	do
299	do.....	do	
300	do.....	do	
301	do.....	do	
302	London Purple.....	do	F. L. Lavanburg, New York City.
303	do.....	do	
304	Purple Poison.....	do	Meyer Bros. Drug Co., St. Louis, Mo.
305	Bollene Insecticide.....	do	Bollene Manufacturing Co., Galveston, Tex.
306	White Arsenic.....	do	
307	Slug Shot.....	do	Benj. Hammond, Fishkill on the Hudson, N. Y.
308	Insecticide.....	do	McLean & Graum, Caldwell, Tex.

231 & W	Potassium Cyanide.....	Unpublished data of Bureau of Chemistry U. S. Department of Agriculture.	Eimer & Amend, New York City.
241 & W	Royal Concentrated Lye.....	do.....	Commercial Lye Co., New York City.
261 & W	Formalin.....	do.....	E. Schering, Berlin, Germany.
281 & W	Copper Carbonate.....	do.....	Eimer & Amend, New York City.
631 & W	Excelsior Insecticide and Wood Preserver (Red Cedar brand). .....do.....	do.....	
1121 & W	White Arsenic.....	do.....	Spotchofz & Ameshot, Amsterdam, Holland.
1131 & W	.....do.....	do.....	Bollene Manufacturing Co., New York, Baltimore, and Galveston.
2021 & W	Fly Preventative.....	do.....	J. W. Barwell, Waukegan, Ill.
6411 & W	Bollene Insecticide.....	do.....	Baker, Adamson & Co., Easton, Pa.
6451 & W	.....do.....	do.....	
9461 & W	Karlo-Kresolate.....	do.....	
11701 & W	Potassium cyanid (99 per cent).....	do.....	

PARIS GREENS.

The analyses of a large number of samples of Paris Green are given in Table II, together with notes that aid in explaining the methods of analysis used. Whenever the method of analysis was given in the original publication it is quoted in full, not only in this table, but throughout the bulletin, in order that the reader may judge for himself of its accuracy. In a number of cases in which only one or two constituents were determined in samples of Paris greens the average of all the results is given, mentioning, however, the number that fall below the generally accepted standard for such goods.

METHODS.

The method of determining arsenious oxid in samples Nos. 1 to 6, inclusive, was as follows:

Weigh 1 gram of the material into a beaker, add 30 cc of strong hydrochloric acid and digest at a temperature below the boiling point, adding small quantities of KClO_3 at frequent intervals. Continue heating until the odor of chlorin has disappeared, dilute with water, add ammonia in slight excess, cool, add magnesia mixture drop by drop, stirring vigorously, and let stand twelve hours. Filter, wash with ammonia water, and dry. Detach precipitate from filter and ignite filter, using ammonium nitrate. Transfer the precipitate to a porcelain crucible and heat for a while on an iron plate and finally in the direct flame. Add filter ash and weigh as magnesium pyro-arsenate.

In samples Nos. 37 to 55, inclusive (19 samples), the following method was used for determining soluble arsenious oxid:

Allow 0.5 gram of the green to stand in suspension in 50 cc of distilled water in a stoppered cylinder for one week, with occasional shaking, and titrate an aliquot filtered portion of this solution for arsenious oxid.

The method for determining total arsenious oxid in samples Nos. 69 to 80, inclusive, was practically the same as that used for samples Nos. 1 to 6, inclusive.

In determining total arsenious oxid in samples Nos. 198 to 264, inclusive (62 samples), the method given in Bulletin 68, Bureau of Chemistry, U. S. Department of Agriculture, for the total arsenious oxid in Paris Green was used. In determining copper the electrolytic method was used. In determining soluble arsenious oxid 1 gram was suspended in 1,000 cc of water and allowed to stand over twenty-four hours in a stoppered flask, with occasional shaking. The arsenious oxid going into solution was titrated with iodine solution.

The soluble arsenious oxid in sample No. 285 was determined by extracting 1 gram of Paris Green with 400 cc of water for nine days, with occasional shaking, and titrating the arsenious oxid in an aliquot portion of the resulting solution with iodine.

TABLE II.—Composition of Paris greens.

Sam- ple No.	Moisture.	Total arsenious oxid (As ₂ O ₃).	Total copper oxid (CuO).	Acetic acid.	Sulphur trioxid (SO ₃).	Silica (SiO ₂).	Sodium oxid (Na ₂ O).	Calcium oxid (CaO).	Soluble arsenious oxid (As ₂ O ₃).	Arsenious oxid in combina- tion with copper.	Remarks.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
1	55.42	This sample contained neither copper nor arsenic, but consisted of a mixture of prussian blue, chrome yellow, and either clay or chalk.
2	55.01	.....	.....	.....	.....	.....	.....	.....	.....
3	59.71	.....	.....	.....	.....	.....	.....	.....	.....
4	53.13	.....	.....	.....	.....	.....	.....	.....	.....
5	57.38	.....	.....	.....	.....	.....	.....	.....	.....
6	54.15	.....	.....	.....	.....	.....	.....	.....	.....
7	0.00	0.00	.....	.....	.....	.....	.....	.....	.....
8	1.02	54.07	33.46	11.45	This sample also contained a trace of potassium oxid, 0.58 per cent zinc oxid, and 0.75 per cent of prussian blue.
9	55.73	32.54	11.15	.....	.....	.....	.....	.....	.....
10	2.48	54.38	34.19	8.95	.....	.....	.....	.....	.....	.....
11	.94	38.21	30.67	30.15	.....	.....	.....	.....	.....	.....
12	56.18	.....	.....	.....	.....	.....	.....	.....	.....
13	55.96	.....	.....	.....	.....	.....	.....	.....	.....
14	1.31	54.08	31.25	11.28	0.23	0.10	0.77	0.10	23.60	.....
22	52.94	32.60	Present.	Present.	29.40	The manufacturers of this Paris green claimed 64 per cent arsenious acid and 20 per cent of copper oxid.
23	55.13	26.70	.....	.....	.....	.....	.....	24.60	.....
24	2.00	48.97	27.93	.....	1.99	.....	1.51	.....	6.70	.....
25	48.27	28.06	.....	1.30	.....	1.01	.....	8.10	.....
26	48.68	34.00	.....	.85	.....	.65	.....	9.10	.....
31	1.34	61.25	33.35	3.93	.....	.13	.....	.....	.....	.....
34	53.61	29.95	.....	.....	.....	.....	.....	.....	.....
37	55.69	31.38	3.82	In sample No. 34 the figure for arsenious oxid is an average of 7 Paris greens, one of which contained below 50 per cent arsenious oxid, having only 39.61 per cent. The figure for copper oxid is an average of 2 Paris greens.
38	55.68	31.54	.....	.....	.....	.....	.....	2.44	.....
39	57.07	31.38	.....	.....	.....	.....	.....	5.52	.....
40	57.33	31.24	.....	.....	.....	.....	.....	3.93	.....
41	60.49	30.53	.....	.....	.....	.....	.....	3.92	.....
42	58.18	31.10	.....	.....	.....	.....	.....	3.39	.....
43	56.17	29.39	.....	.....	.....	.....	.....	2.86	.....
44	55.56	30.77	.....	.....	.....	.....	.....	3.52	.....
45	55.29	29.55	.....	.....	.....	.....	.....	3.58	.....
46	56.84	31.16	.....	.....	.....	.....	.....	3.30	.....
47	56.09	30.68	.....	.....	.....	.....	.....	2.80	.....
48	55.68	31.14	.....	.....	.....	.....	.....	3.11	.....

TABLE II.—Composition of *Paris greens*—Continued.

Sample No.	Moisture.	Total arsenious oxid. (As_2O_3).	Total copper oxid. (CuO).	Acetic acid.	Sulphur trioxid. (SO_3).	Silica (SiO_2).	Sodium oxid. (Na_2O).	Calcium oxid. (CaO).	Soluble arsenious oxid. (As_2O_3).	Arsenious oxid. in combination with copper.	Remarks.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
49	56.84	30.14	.....	.....	.....	.....	.....	3.33	.....
50	56.96	30.10	.....	.....	.....	.....	.....	2.61	.....
51	56.72	29.09	.....	.....	.....	.....	.....	2.72	.....
52	56.78	30.21	.....	.....	.....	.....	.....	2.98	.....
53	56.48	30.72	.....	.....	.....	.....	.....	3.21	.....
54	61.05	28.50	.....	.....	.....	.....	.....	4.32	.....
55	56.23	30.58	.....	.....	.....	.....	.....	2.41	.....
56	47.53	34.81	.....	.....	.....	.....	21.31	.....	.....
57	29.21	9.78	.....	.....	.....	.....	.....	.....	.....
58	49.49	34.18	.....	.....	.....	.....	.....	.....	.....
59	43.57	32.35	.....	.....	.....	.....	.....	.....	.....
60	49.57	30.43	.....	.....	.....	.....	.89	.....	.....
61	48.64	31.02	.....	.....	.....	.....	.....	1.98	.....
62	56.57	29.23	.....	.....	.....	.....	.....	2.28	.....
63	56.32	29.23	.....	.....	.....	.....	.....	1.88	.....
64	58.15	29.76	.....	.....	.....	.....	.....	.....	.....
69	52.55	.....	.....	.....	.....	.....	.....	.....	.....
70	52.72	.....	.....	.....	.....	.....	.....	.....	.....
71	50.85	.....	.....	.....	.....	.....	.....	.....	.....
72	55.91	.....	.....	.....	.....	.....	.....	.....	.....
74	54.73	.....	.....	.....	.....	.....	.....	.....	.....
75	54.17	.....	.....	.....	.....	.....	.....	.....	.....
76	53.97	.....	.....	.....	.....	.....	.....	.....	.....
77	53.41	.....	.....	.....	.....	.....	.....	.....	.....
78	54.37	.....	.....	.....	.....	.....	.....	.....	.....
79	53.17	.....	.....	.....	.....	.....	.....	.....	.....
80	53.50	.....	.....	.....	.....	.....	.....	.....	.....
81	1.38	54.85	32.55	.....	.....	.....	.....	.....	.....	.....
82	1.05	54.14	3.	.....	.....	.....	.....	.....	.....	.....
83	1.67	53.73	30.60	.....	.....	.....	.....	.....	.....	.....
84	1.20	56.04	32.30	.....	.....	.....	.....	.....	.....	.....
85	5.00	58.44	8.30	.....	7.56	1.40	.....	14.50	.....	.....

This figure is the average of 10 Paris greens, 2 of which contained less than 50 per cent arsenious oxid, viz, (1) 41.28 per cent, manufactured by C. T. Reynolds & Co., New York City; (2) 49.82 per cent, manufacturer unknown.

Average of 2 Paris greens, one containing less than 50 per cent arsenious oxid (48.47 per cent, manufactured by Wetland & Meissner).

This figure is the average of 8 Paris greens.

This figure is the average of 39 Paris greens, 1 containing less than 50 per cent arsenious oxid (48.63 per cent, manufacturer unknown).

Average of 39 Paris greens; 1 contained less than 50 per cent arsenious oxid (49.69 per cent, obtained of Marth & Ducote, Lafayette, Iowa).

Average of 36 Paris greens.

Average of 149 Paris greens.

Average of 79 Paris greens.

Average of 35 Paris greens.

Average of 19 Paris greens; 1 contained less than 50 per cent arsenious oxid (49.38 per cent, manufacturer unknown).

This sample also contained 0.37 per cent of magnesium oxid.

This sample also contained 0.56 per cent of magnesium oxid.
 This sample also contained 1.15 per cent of magnesium oxid and
 0.04 per cent of potassium oxid.
 This sample also contained 1.37 per cent of magnesium oxid and
 0.03 per cent of potassium oxid.

This sample is a composite of 3 greens manufactured by the
 same person.

This sample is a composite of 2 samples manufactured by the
 same firm.

In reporting samples Nos. 138-141, inclusive, the chemist reported
 the copper as copper hydrate, added the copper hydrate,
 moisture, and arsenious acid together and subtracted from 100,
 reporting the remainder as impurities. The acetic acid was
 not taken into account.

This figure is an average of 5 Paris greens.

86	4.29	63.98	6.60	5.80	.60	3.23	15.38		
87		47.52	8.96	7.47			15.67		
88	.71	49.70	7.88	5.78		2.36	16.88		
94	.71	57.44	30.59						
95	.75	56.40	30.14						
96	.53	58.57	30.35						
97	.55	56.73	30.62						
98	.56	59.72	30.61						
99	.60	59.38	29.85						
100	.34	58.45	29.26						
101	.60	57.67	30.15						
102	.66	58.08	29.73						
103	.52	57.87	29.49						
104	.55	58.03	30.72						
105	3.72	52.78	21.65						
106	.96	58.06	30.65						
107	.45	58.99	28.44						
108	.60	59.04	30.35		.05				
109	.55	61.15	28.00		.01				
110	.63	60.38	29.83						
111	.33	60.37	29.51		.14				
112	.78	60.71	30.32		.02				
113	.39	60.60	28.95		.15				
114	.86	60.04	29.94		.02				
115		58.52	30.80						
118	1.34	61.25	33.35	3.93	.13				
119	1.31	61.21	33.45	3.91	.09				
123	1.30	62.65	32.84	3.10	.21				
124	1.41	61.40	33.20	3.90	.09				
125	1.40	63.10	33.10	3.71	.64				
126	1.15	59.92	30.40		.10				
127	1.15	53.91	31.27	8.10					
128	1.27	54.80	30.85	6.50	.12				
138	.67	54.48	35.60						
139	.98	54.74	34.23						
140	1.00	56.14	33.30						
141	.97	56.46	33.20						
142		57.17	30.26				1.24		
143		53.52	29.38				1.09		
144		60.26	29.68				1.23		
145		57.67	31.08				1.14		
146		57.42	31.36				.84		
147		59.40	30.80				1.09		
152		55.99							

TABLE II.—Composition of *Paris greens*—Continued.

Sam- ple No.	Moisture.	Total arsenious oxid (As ₂ O ₃).		Acetic acid.	Sulphur trioxid (SO ₃).	Silica (SiO ₂).		Sodium oxid (Na ₂ O).	Calcium oxid (CaO).	Soluble arsenious oxid (As ₂ O ₃).		Arsenious oxid in combina- tion with copper.	Remarks.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.		
159	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	The 43.3 per cent, insoluble in hydrochloric acid, consisted of 30.6 per cent silica, 5 per cent oxids of iron, and aluminum and other constituents. This green was evidently composed of about equal parts of Paris Green and earthy matter, such as clay or infusorial earth.
160	64.88	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
161	47.82	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
162	56.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
163	68.59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
164	58.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
165	41.54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
166	56.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
167	63.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
168	67.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
169	66.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
170	50.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
177	54.73	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
184	56.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
192	56.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
198	56.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
199	56.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
200	56.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
201	56.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
202	56.81	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
203	56.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
204	59.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
205	58.16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
206	56.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
207	57.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
208	57.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
209	56.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
210	57.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
211	56.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
212	56.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
213	56.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
214	55.83	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
215	56.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
216	60.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
217	57.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
218	56.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
219	56.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

This figure is the average of 5 Paris greens.

These figures are the averages of 24 Paris greens.

225	57.11	30.04	.....	.....	.....	1.47	56.27
226	57.66	30.04	.....	.....	.....	1.47	56.27
227	57.97	30.29	.....	.....	.....	.88	56.74
228	56.93	30.10	.....	.....	.....	2.64	56.38
229	57.11	30.23	.....	.....	.....	.88	56.63
230	57.81	30.48	.....	.....	.....	1.47	57.10
231	56.93	30.35	.....	.....	.....	1.10	56.85
232	57.42	28.54	.....	.....	.....	1.53	53.46
233	57.11	29.22	.....	.....	.....	1.53	54.73
234	57.35	29.60	.....	.....	.....	1.53	55.56
235	57.72	29.41	.....	.....	.....	1.65	56.09
236	57.42	31.23	.....	.....	.....	1.35	57.42
237	57.85	30.08	.....	.....	.....	1.23	56.35
238	58.76	30.41	.....	.....	.....	.98	56.97
239	58.82	30.16	.....	.....	.....	1.10	56.50
240	61.40	27.47	.....	.....	.....	1.78	51.46
241	62.87	26.78	.....	.....	.....	2.21	50.17
242	62.69	26.53	.....	.....	.....	1.53	49.70
243	57.91	30.16	.....	.....	.....	.98	56.50
244	57.91	30.48	.....	.....	.....	.98	57.10
245	58.82	29.91	.....	.....	.....	1.15	56.03
246	58.03	29.85	.....	.....	.....	1.23	55.91
247	57.11	30.01	.....	.....	.....	.98	56.21
248	56.13	29.51	.....	.....	.....	1.23	53.34
249	57.42	30.50	.....	.....	.....	1.23	57.13
250	57.42	30.41	.....	.....	.....	.98	56.97
251	57.11	30.04	.....	.....	.....	1.47	56.27
252	58.09	30.23	.....	.....	.....	1.72	56.63
253	58.46	30.35	.....	.....	.....	.98	56.85
254	57.35	30.04	.....	.....	.....	1.10	56.27
255	57.72	30.73	.....	.....	.....	.88	57.57
256	58.09	30.29	.....	.....	.....	1.35	56.74
257	60.72	28.35	.....	.....	.....	1.40	53.11
258	57.29	30.51	.....	.....	.....	1.10	57.21
259	57.60	30.85	.....	.....	.....	.88	57.60
260	57.84	30.48	.....	.....	.....	.88	57.10
261	58.58	29.60	.....	.....	.....	1.40	55.45
262	57.60	30.29	.....	.....	.....	.88	56.71
263	57.72	31.14	.....	.....	.....	.98	57.72
264	58.09	30.16	.....	.....	.....	.98	56.50
273	58.53	30.92	8.00	.....	.....	.....	.....
274	58.99	28.95	7.50	.....	.....	.....	.....
279	54.43	29.47	.....	.....	.....	.....	.....
283	40.36	.....	.....	.....	.....	.....	.....
285	56.00	30.32	.....	.....	.....	.....	.....
286	57.08	30.10	11.42	.....	.....	2.88	.....
291	57.06	.....	.....	.....	.....	.....	.....

The amount of arsenious oxid in combination with copper is calculated by assuming that all copper present is combined except when formed in excess. This calculation is necessary because the present New York law requires that Paris Green shall contain arsenic in combination with copper equivalent to not less than 50 per cent of arsenious oxid.

The figure 54.53 is the average of 18 Paris greens, 8 of which are below 50 per cent arsenious oxid (viz. 46.86 per cent, 37.80 per cent, 45.51 per cent, 45.08 per cent, 40.98 per cent, 46.16 per cent, 34.10 per cent, 46.60 per cent; manufacturers unknown). The figure 29.47 is the average of 12 Paris greens.

TABLE II. — *Composition of Paris greens—Continued.*

Sam- ple No.	Moisture.	Total arsenious oxid (As_2O_3).	Total copper oxid (CuO).	Acetic acid.	Sulphur trioxid (SO_3).	Silica (SiO_2).	Sodium oxid (Na_2O).	Calcium oxid (CaO).	Soluble arsenious oxid (As_2O_3).	Arsenious- oxid in combina- tion with copper.	Remarks.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	
297	55.30	29.77	.....	.....	.....	.....	.....	0.95	.....	Analysis made in accordance with Texas law regulating sale of Paris greens and other insecticides and is only good until May 1, 1903.
298	57.25	30.00	.....	.....	.....	.....	.....	.92	.....	Analysis made under Texas law; good only until May 1, 1902.
299	55.15	29.74	.....	.....	.....	.....	.....	.76	.....	Do.
300	57.63	31.20	.....	.....	.....	.....	.....	.60	.....	Do.
301	55.45	29.05	.....	.....	.....	.....	.....	1.00	.....	Do.

COMMENT ON ANALYSES.

A glance at Table II at once makes it apparent that only 1 sample out of more than 650 examined contains neither copper, acetic acid, nor arsenious oxid—this is sample No. 7. One other sample, No. 159, consists of about equal parts Paris Green and some insoluble material that appears to be clay or infusorial earth. Out of the total number examined 31 contained less than 50 per cent arsenious oxid. It will be noted, however, that a number of these samples said to contain less than 50 per cent arsenious oxid were analyzed by a method (the magnesium pyro-arsenate method) that has since been shown to give results about 1 per cent low. If a more accurate method of analysis had been used, the number falling below 50 per cent arsenious oxid would very likely be materially diminished. It also appears that the Western States receive more of those samples that contain small percentages of arsenious oxid than do the Northern States.

The State of Louisiana, which previous to 1899 occasionally received samples containing small percentages of arsenious oxid, does not seem to have had any upon the market during 1899 and 1900. Out of 96 samples of Paris Green examined in New York State during the years 1899 to 1901, inclusive, none was found that contained less than 50 per cent arsenious oxid. In both California and Oregon, until a very recent date, quite a large amount of the Paris Green on the market contained small percentages of arsenious oxid, although it is said that this condition has been very much improved during the last two years.

Concerning soluble arsenious oxid in Paris greens, it appears that those upon the market in California until recently contained very large quantities, those in Idaho were very fair, only 2 out of 19 containing more than 4 per cent, those in Illinois, Montana, and Texas contained very small percentages, and those in New York the same, only 1 out of 90 containing more than 4 per cent. This one was sample No. 204, containing 15.69 per cent of free arsenious oxid.

It must be borne in mind, however, in looking over the figures for free arsenious oxid that the results in one State can not be compared with those in another, since the methods of analysis were very likely different in every case and would lead to entirely different results. It may be of interest to those who have not read the previous bulletin of the Bureau of Chemistry on this subject to mention that out of the 45 samples of Paris Green, from all parts of the United States, which were examined 71 per cent contained more than 4 per cent of soluble arsenious oxid and 16 per cent contained more than 6 per cent of arsenious oxid when a ten-day extraction of 1 gram with 1,000 cc of water was made. In view of the facts brought out in that bulletin, a 6 per cent, rather than a 4 per cent, limit for soluble arsenious oxid was advocated when the above method of analysis was employed.

From the figures given above, together with information received from the various States, it appears that upon the whole the purity of the Paris greens upon the American market is steadily and rapidly upon the increase.

LONDON, ENGLISH, AND PARIS PURPLES.

The analyses of 10 samples of London Purple, 1 sample of English Purple, and 3 samples of Paris Purple are given in the following table (III). All of these are products obtained by boiling a waste product from the analine-dye industry with lime. Since it was not known at the time these analyses were made that the arsenic was present, both as arsenious and arsenic acids, the total arsenic was determined and reported as arsenious oxid, only the soluble arsenious oxid being determined, instead of both soluble arsenic and arsenious oxids.

TABLE III.—*Composition of London purples and closely allied mixtures.*

Sample No.	Name.	Moisture.	Arsenious oxid (As_2O_3).	Calcium oxid (CaO).	Ferric oxid and alumina (Fe_2O_3 and Al_2O_3).	Sulphur trioxid (SO_3).	Dye.	Soluble arsenious oxid (As_2O_3).
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
148	London Purple		51.43					0.54
149	.....do.....		37.18					2.58
153	.....do.....		37.56					
175	.....do.....	3.27	41.44	24.32	3.37	0.31	27.29	(a)
195	.....do.....		32.88					
268	.....do.....		32.32					12.21
284	.....do.....	3.99	42.60					
287	.....do.....	3.37	46.73	24.35	1.31	b.46		
302	.....do.....		31.90	c 25.78				
303	.....do.....		31.50	d 25.00				
178	English Purple		36.75					5.26
179	Paris Purple		47.05					11.86
180	.....do.....		34.10					13.78
288	.....do.....	6.05	33.72	4.55	4.76	e.91		

^a A portion digested 40 hours with water at room temperature gave 8.11 per cent arsenious oxid and 2.85 per cent soluble calcium oxid. A portion digested with hot water until all the soluble arsenious oxid had dissolved gave 16.45 per cent soluble arsenious oxid and 3.26 per cent soluble calcium oxid.

^b Also contains 1.65 per cent nitrogen.

^c This analysis was made in accordance with the Texas law regulating the sale of Paris Green and other insecticides and is good only until May 1, 1903.

^d Made in accordance with Texas law, but good only until May 1, 1902.

^e Also contained 2.8 per cent nitrogen and 0.37 per cent potassium oxid.

It will at once be noted that the variation in the amount of arsenic in different samples of London Purple and Paris Purple is very large. In the case of 11 samples examined more recently in this Bureau (published in Bulletin 68) this variation in the arsenic content is not nearly so great. It would, therefore, appear that the amount of this constituent in such goods is becoming more constant in the more recently manufactured samples.

The figures for soluble arsenious oxid can not be compared with those obtained more recently in this laboratory, since the soluble arsenic oxid was not determined in the earlier analyses, and it is only when both figures are at hand that any conclusions of a positive nature can be drawn.

INSECTICIDES AND FUNGICIDES, OTHER THAN PARIS GREEN AND LONDON PURPLE, THAT CONTAIN ARSENIC, COPPER, OR BOTH, AS THEIR ACTIVE CONSTITUENTS.

In Table IV is given a compilation of analyses of Green Arsenoid, Green Arsenite, Paragrene, Laurel Green, and White Arsenic, together with two analyses of White Arsenic made in this laboratory.

TABLE IV.—*Composition of Green Arsenoid, Green Arsenite, Paragrene, Laurel Green, and White Arsenic.*

Sample No.	Name.	Moisture.	Total arsenious oxid (As ₂ O ₃).	Copper oxid (CuO).	Calcium oxid (CaO).	Sulphur trioxid (SO ₃).	Soluble arsenious oxid (As ₂ O ₃).
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
29 <i>a</i>	Green Arsenoid	2.77	61.43	28.83	.....	.....	7.82
90	do	1.44	50.77	31.90	.....	.....	.....
189	do .....	.....	60.63	29.29	.....	1.55	3.53
190	do. [No. 53] .....	.....	53.71	29.43	.....	3.70	8.33
220	do	1.91	58.82	30.76	.....	.....	2.94
186	Green Arsenite .....	.....	54.10	31.59	.....	3.70	2.36
30 <i>b</i>	Paragrene	6.20	40.60	23.46	.....	.....	23.08
58	do .....	.....	19.31	19.92	13.31	.....	.....
185	do .....	.....	55.57	27.68	.....	1.34	3.21
193	do .....	.....	43.34	18.08	.....	.....	.....
194	do .....	.....	52.30	21.64	.....	.....	.....
221	do	8.75	36.11	17.87	14.20	.....	1.47
92	Laurel Green	7.64	7.34	13.50	26.31	.....	.....
182	do .....	.....	7.75	12.52	.....	.....	.....
191	Laurel Green (special) .....	.....	42.69	4.50	35.39	.....	1.15
196 <i>c</i>	Laurel Green .....	.....	3.83	11.50	.....	.....	.....
266	do .....	.....	4.85	12.68	.....	.....	.00
267	do .....	.....	5.45	12.05	.....	.....	.00
306 <i>d</i>	White Arsenic .....	.....	98.00	.....	.....	.....	.....
142 (I. & W.) <i>e</i>	do .....	.....	99.86	.....	.....	.....	.....
143 (I. & W.) <i>e</i>	do .....	.....	99.99	.....	.....	.....	.....

a The following constituents were also present: Silica, 0.40 per cent; organic matter, 6.67 per cent.

b In sample No. 30 the following constituents were also present: Acetic acid, 6.72 per cent; calcium sulphate, 19.31 per cent; sodium sulphate, 2.26 per cent; sodium chlorid, 0.25 per cent; ferric oxid, 0.20 per cent.

c Large amounts of calcium carbonate and hydrate were also present.

d This analysis was made in accordance with the Texas law regulating the sale of Paris Green and other insecticides and is good only until May 1, 1902.

e The method of analysis used is that described for total arsenious oxid in Paris Green in Bulletin 65 of this Bureau.

The figures obtained by different analysts for Green Arsenoid, Paragrene, and Laurel Green show that the composition of these substances is very variable, especially as to the content of arsenious oxid, which varies in the first case from 50.77 per cent to 61.43 per cent, in the second from 19.31 per cent to 55.57 per cent, and in the third from 3.83 per cent to 42.69 per cent. The figures obtained for soluble arsenious oxid, here as elsewhere in this compilation, can not be compared, since the methods of extraction were very likely different.

The two samples of White Arsenic analyzed in this laboratory were received from Boise City, Idaho, by the Division of Entomology. They are both evidently of exceptional purity and will give good results when used for preparing Calcium Arsenite, the purpose for which they were purchased.

WHITE ARSENOIDS.

TABLE V.—*Composition of White Arsenoids.*

Constituents.	Sample No. 27.	Sample No. 91.
	<i>Per cent.</i>	<i>Per cent.</i>
Barium oxid.....	42.39	41.43
Barium to join with chlorin.....	8.60	6.16
Lead oxid.....	1.55	.96
Carbon dioxid.....	10.15	8.92
Chlorin.....	4.45	3.19
Silica.....	.20	.....
Arsenious oxid.....	27.64	31.90
Moisture.....	4.00	2.35
Soluble arsenious oxid.....	27.64	.....

PARIS GREEN AND BORDEAUX MIXTURE.

The composition of this sample, No. 270, was as follows:

	<i>Per cent.</i>
Total arsenious oxid.....	15.49
Copper oxid.....	16.02
Soluble arsenious oxid.....	1.72

SLUG SHOTS.

TABLE VI.—*Composition of Slug Shots.*

Constituents.	Sample No. 181.	Sample No. 290.	Sample No. 307.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Arsenious oxid.....	0.60	1.58	.....
Copper oxid.....	1.44	.60	.....
Lime.....	.....	30.25	28.82
Sulphur trioxid.....	.....	43.02	41.18
Ferric oxid and alumina.....	.....	.79	.....
Sodium chlorid.....	.....	2.83	.....
Insoluble.....	.....	1.38	.....
Volatile organic matter (by difference).....	.....	4.79	.....

The sodium chlorid in sample No. 290 was calculated from a content of 1.72 per cent of chlorin. The volatile organic matter in this sample consisted principally of dead oil.

In sample No. 307 small amounts of sulphur, copper sulphate, oxid of iron, carbolic acid, and tobacco, with less than 1 per cent of arsenic, were also present.

Slug Shot is evidently a mixture of fairly constant composition containing in all cases small amounts of arsenious oxid and copper oxid as active poisonous constituents.

PEROXID OF SILICATES.

TABLE VII.—*Composition of peroxid of silicates.*

Constituents.	Sample No. 135.	Sample No. 289.
	<i>Per cent.</i>	<i>Per cent.</i>
Moisture.....	1.65	1.44
Arsenious oxid.....	.57	1.47
Copper oxid.....	.33	.28
Sulphur trioxid.....	49.66	52.29
Calcium oxid.....	41.18	36.43
Insoluble.....	2.31	1.93
Ferric oxid and alumina.....	.....	1.40
Organic and volatile matter (by difference).....	.....	4.76

This mixture evidently contains arsenious oxid and copper as the active constituents, diluted with a large amount of gypsum. In so far as the arsenious oxid and copper content are concerned, this mixture is of value as an insecticide; but the gypsum is inert in its action upon insects, except that when the spiracles are not well protected they may be closed up with this or any other fine dust.

BLACK DEATH.

Composition of Black Death.

[No. 222.]

	Per cent.
Moisture.....	9.78
Sulphate of lime (gypsum).....	45.34
Magnesium oxid.....	3.98
Ferric oxid and alumina.....	3.02
Arsenious oxid.....	.79
Copper oxid.....	.41
Silica.....	5.42
Loss on ignition.....	28.91

ENGLISH BUG COMPOUND.

The composition of this compound, No. 265, is as follows:

	Per cent.
Arsenious oxid.....	1.46
Copper oxid.....	.60

ORIENTAL FERTILIZER AND BUG DESTROYER.

[No. 136.]

Composition of Oriental Fertilizer and Bug Destroyer.

	Per cent.
Water.....	37.14
Total solids.....	12.86
Arsenic oxid.....	2.38
Potassium oxid.....	3.50
Sodium oxid.....	6.08
Nitrogen.....	.67
Chlorin.....	3.00
Sulphur trioxid.....	.64

This mixture is evidently sodium and potassium arsenates dissolved in water. In so far as its content of arsenic is concerned, it would be of value in killing insects. It might, however, if sprayed upon trees, cause some damage by scorching, as the arsenic is in a soluble condition. Its fertilizing value is shown by its content of potash and nitrogen.

Another sample of Oriental Fertilizer and Bug Destroyer, No. 150, gave, in 1,000 cc of liquid, 13.12 grams of arsenic and 10.28 grams of potassium oxid.

LEAD ARSENATE AND PINK ARSENOID.

The analyses of samples of Lead Arsenate and Pink Arsenoid, or Lead Arsenite, are given in the following table:

TABLE VIII.—*Composition of Lead Arsenate and Pink Arsenoid.*

Sample No.	Name.	Moisture.	Lead oxid (PbO).	Arsenic oxid (As_2O_5).	Arsenious oxid (As_2O_3).	Soluble arsenious oxid (As_2O_3).
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
a 271	Di-parene	40.40	38.50	13.28	.....	.....
b 272	Lead Arsenate	56.64	39.14	14.83	.....	.....
c 292	do	29.00	40.60	.....	d 21.20	.....
e 293	do	f 35.30	32.34	.....	d 30.00	.....
e 294	do	f 31.50	44.40	.....	d 18.00	.....
e 295	do	f 37.40	44.98	.....	d 14.70	.....
e 296	do	32.42	34.83	.....	d 30.62	.....
g 28	Pink Arsenoid .....	.31	49.58	.....	43.26	3.24
89	do .....	.35	53.83	.....	40.16	.....
188	do .....	.....	49.09	.....	49.19	1.93

a All the lead oxid calculated to $\text{Pb}_3(\text{AsO}_4)_2$ leaves an excess of 0.05 per cent arsenic oxid, probably combined as sodium arsenate.

b All the lead oxid calculated to $\text{Pb}_3(\text{AsO}_4)_2$ leaves an excess of 1.38 per cent arsenic oxid, probably combined as sodium arsenate.

c This analysis was made in accordance with the Texas law regulating the sale of Paris Green and other insecticides and is good only until May 1, 1903. In addition to constituents named, 2.7 per cent organic matter was found.

d The chemist reported arsenic in the following ways on these 5 samples: (1) White arsenic, (2) total arsenic, (3) white arsenic, (4) white arsenic, (5) arsenious oxid. These terms are usually applied to arsenic when in the "ous" condition and mean so much As_2O_3 . If these compounds are arsenates, as claimed, the arsenic should be reported as As_2O_5 . In several of the above analyses, however, if the figures as given were calculated to As_2O_5 , the sum total of the constituents would be markedly above 100 per cent.

e Analysis made according to Texas law, but good only until May 1, 1902.

f Includes organic matter also.

g In addition to constituents named 6.85 per cent of organic matter, lead sulphate, etc., was found.

It is at once evident that the variation in the composition of samples of Lead Arsenate is considerable, depending to a large extent on the variation in the moisture content and somewhat on the variation in method of manufacture. These differences in composition should be borne in mind in using such compounds for spraying purposes, since some of them would not have the same insect-killing powers as others at the same dilution. Pink Arsenoid, although somewhat variable in composition, is much more constant than is Lead Arsenate.

XX, PURPLE POISON, AND INSECTICIDE.

TABLE IX.—*Composition of XX, Purple Poison, and Insecticide.*

Constituents.	XX (No. 187).	Purple Poison (No. 304). ^a	Insecticide (No. 308). ^a
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Total arsenious oxid	33.71	30.6	8.00
Calcium oxid .....	.....	8.5	.....
Lead oxid (combined) .....	.....	.....	15.90
Organic matter (fixed) .....	.....	.....	66.60
Organic matter (volatile) .....	.....	.....	9.50
Soluble arsenious oxid	32.23	9.5	8.00

a The Purple Poison, sample No. 304, also contains coloring matter. The two analyses, Nos. 304 and 308, were made in accordance with the Texas law regulating the sale of Paris Green (see page 61) and other insecticides and holds good only until May 1, 1903.

None of the three analyses is sufficiently complete to show definitively the chemical composition of the compound examined, although from the data as given the Purple Poison appears to be at least partially composed of London Purple or some closely allied product.

COPPER CARBONATE.

[No. 28 I and W.]

The analysis of this sample in the Bureau of Chemistry showed that it contained 58.24 per cent of total copper oxid. It is basic in character and of somewhat variable composition, so that the purity can not be calculated from the copper-oxid content. It contains, however, a somewhat smaller amount of copper oxid than other samples examined in this laboratory. The method of analysis used was that described in Bulletin 68.

FOSTITE.

Composition of fostite.

[No. 280.]

	Per cent.
Loss at dull-red heat.....	2.92
Soluble in aqua regia:	
Copper oxid.....	2.98
Ferric oxid and alumina.....	1.36
Calcium oxid.....	2.31
Magnesium oxid.....	1.51
Sulphur trioxid.....	3.28
Silica.....	.35
Insoluble in aqua regia.....	83.77
Soluble in hot water.....	7.49

This material is said by the analyst to be composed of copper sulphate and finely powdered soapstone in the ratio of approximately 1:9.

SULPHATINE AND DEATH TO ROSE BUGS.

TABLE X.—*Composition of Sulphatine and Death to Rose Bugs.*

Constituents.	Sulphatine (No. 120).	Death to Rose Bugs (No. 121).
	<i>Per cent.</i>	<i>Per cent.</i>
Moisture.....	1.40	2.95
Calcium oxid.....	18.60	17.76
Copper oxid.....	2.61	1.05
Sulphur trioxid.....	4.73	4.35
Sulphur.....	48.28	34.53
Insoluble.....	1.63	.49
Ash.....		54.14

Neither of the above substances has ever been examined in this laboratory, but from the analyses it would appear that sulphur and copper, probably as copper sulphate, are the active constituents. These are diluted with inert materials, probably to mitigate their action upon the foliage.

SOAPS.

TABLE XI.—Composition of whale-oil soaps.

Sample No.	Moisture.	Potash lye.	Soda lye.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
171.....	27.30	10.55	7.54
172.....	71.58	6.86	4.89
173.....	6.22	13.86	9.90
174.....	6.25	10.66	7.61

The above analyses do not indicate that both soda and potash are present, but show how much of either would be present calculated from the number of cubic centimeters of normal acid necessary to neutralize a known weight of soap.

LYES.

The compiled analyses of a number of samples of lyes and the results on one sample (No. 24 I & W) examined in this laboratory are given in Table XII.

TABLE XII.—Composition of lyes.

Sample number.	Name.	Moisture.	Sodium hydrate (NaOH).	Potassium carbonate (K_2CO_3).	Sodium chlorid (NaCl).	Sodium carbonate (Na_2CO_3).	Sodium sulphate (Na_2SO_4).	Potassium hydrate (KOH).	Potassium sulphate (K_2SO_4).
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
15.....	Solid Lye.....	6.4	22.7	.....	66.6	.....	.....	.....	.....
16.....	Concentrated Lye.....	.5	80.4	.....	5.9	.....	13.2	.....	.....
17.....	Double Concentrated Caustic Soda.....	.....	99.3	.....	.....	.....	.....	.....	.....
18.....	Refined Pearl Ashes.....	23.8	.....	69.1	.....	.....	.....	.....	.....
19 ^a	Commercial Potash.....	1.5	.....	16.8	4.9	.....	14.8	52.3	7.5
20 ^b	Canadian Crude Potash.....	4.5	.....	71.4	.....	2.3	.....	.....	14.4
32.....	Concentrated Potash Lye.....	.58	86.90	.....	7.56	.....	4.85	.....	.....
33 ^c	Concentrated Lye.....	1.87	72.01	.....	16.70	.33	4.94	.....	.....
24 (I & W).	Royal Concentrated Lye.....	.....	70.96	.....	.....	3.17	.....	.....	.....

^a The following constituents were also determined: 2.1 per cent insoluble, and 0.1 per cent silica.

^b The following constituents were also determined: 3.6 per cent potassium chlorid, and 2.7 per cent insoluble.

^c The following constituents were also found: 0.06 per cent of alumina and traces of ferric oxid, magnesium oxid, and insoluble.

The method used for the analysis of the Royal Concentrated Lye (No. 24 I & W) is as follows:^a

The lye is weighed in a weighing bottle, dissolved to a definite volume in carbon-dioxid-free water and aliquot portions taken for analysis. Phenolphthalein is added to one of these portions and N/3 potassium acid sulphate is added at the rate of about a drop per second, with constant stirring until the pink color fades and the solution becomes colorless. The number of cc of N/3 acid used, "n" represents the

sodium hydroxid and one-half the sodium carbonate, since the sodium carbonate is changed to sodium bicarbonate (NaHCO_3). A drop of methyl orange is added and the titration continued until the appearance of a pink color. Let this number of cc be represented by "m." Since this last titration represents the sodium bicarbonate present or one-half the sodium carbonate, "2 m" represents all the sodium carbonate, and "n-m" the sodium hydroxid.

The figures in most cases explain themselves, although a few remarks emphasizing certain points might not be out of place. Sample No. 15 is evidently a very poor example of a soda lye, as two-thirds of it is composed of sodium chlorid. No. 16 is a very fair sample of caustic soda, while No. 17 is a most excellent sample of the same goods. No. 32 is not a potash lye, as it claims to be, but a soda lye. Nos. 32, 33, and 24 I & W are all fair samples of commercial soda lye.

HELLEBORES.

TABLE XIII.—*Composition of hellebores.*

Sample No.	Ash insoluble in hydrochloric acid.	Total ash.	Sample No.	Ash insoluble in hydrochloric acid.	Total ash.
	<i>Per cent.</i>	<i>Per cent.</i>		<i>Per cent.</i>	<i>Per cent.</i>
133.....	2.34		156.....		12.00
134.....	38.12		157.....		10.60
154.....		33.13	158.....		34.00
155.....		16.00			

Samples Nos. 134, 154, and 158 are evidently badly contaminated with dirt, probably because the roots of the plant were not properly cleaned. Sample No. 155 also appears to have a slightly higher ash content than should be allowed in preparations of this kind.

MIXTURES CONTAINING BORAX.

A single example of this class of compounds, the analysis of which was made in this laboratory, is given below:

HOOKER'S COCKROACH AND WATER BUG EXTERMINATOR.

Composition of Hooker's Cockroach and Water Bug Exterminator.

	<i>Per cent.</i>
Camphor	3.5-4.0
Borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10 \text{H}_2\text{O}$)	92.25
Ammonia (NH_3) .....	.27

The remainder is principally organic matter and appears to be tobacco. The ammonia seems to be present as ammonium carbonate.

In making an analysis of this compound the camphor was determined by extracting the powder with ether, allowing it to evaporate at room temperature and weighing at once. While this method leaves

much to be desired, it at least gives approximate results when a large portion of the material is used. The borax was determined by the same method as given in Bulletin 68 for similar compounds, except that the ammonia was all driven off from the solution by boiling before the boric acid was determined.

This mixture would very likely be efficacious in driving away cockroaches and water bugs, but probably it would not kill them.

TOBACCO EXTRACTS.

The analyses of five samples of tobacco extracts are given in Table XIV. In two of these only the most important constituent, nicotin, was determined, while in one of them the determination of this constituent was not made.

TABLE XIV.—*Composition of tobacco extracts.*

Constituents.	Sample No. 116. ^a	Sample No. 117. ^b	Sample No. 130.	Sample No. 131.	Sample No. 132.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Moisture	37.710	40.890			10.00
Ash.....	19.420	27.770			
Total nitrogen.....	2.010	1.730			
Nitrogen as nitrates.....	.170				
Nicotin.....	2.115	.530	4.55	4.82	
Ferric oxid and alumina.....	.229	.017			
Calcium oxid.....	3.069	1.466			4.45
Magnesium oxid.....	2.303	1.121			
Phosphorus pentoxid.....	.404	.057			
Sodium oxid.....	.207	.525			
Potassium oxid.....	6.550	16.340			9.15
Insoluble.....	Trace.				2.12

^a Specific gravity, 1.3858.

^b Specific gravity, 1.3777.

In the first four of these samples the nicotin figure is much too low for a good tobacco extract; especially is this true of the first two.

FORMALINS.

The analysis of three samples of formalin, and the average of the results obtained on five samples, together with one analysis made in this laboratory, are given in the following table:

TABLE XV.—*Composition of formalins.*

Sample No.	Formaldehyde.	
	By weight.	By volume.
	<i>Per cent.</i>	<i>Per cent.</i>
65.....	36.9	40.8
66.....	37.0	40.0
67.....	38.9	41.9
68.....	^a 36.69	
26 (I & W).....	37.18	

^a Average of 5 samples.

The method used for determining formaldehyde in samples 65 to 68, inclusive, is as follows: ^a

Fifteen cubic centimeters of N 10 AgNO₃ are treated with 5 drops of 50 per cent nitric acid in a 50 cc flask. Ten cc of a solution of potassium cyanid (containing 3.1 grams of 96 per cent potassium cyanid in 500 cc of water) are then added, the flask filled to the mark with distilled water, well shaken, and an aliquot portion of the filtrate, say 25 cc, titrated according to the method of Volhart with a N 10 solution of ammonium sulphocyanate for the excess of silver.

Another 15 cc portion of N 10 AgNO₃ is treated with 5 drops of 50 per cent nitric acid and 10 cc of the potassium cyanid solution, to which has been added a known amount of the formalin solution. The whole is made up to 50 cc, and a 25 cc filtrate from it titrated with N 10 ammonium sulphocyanate, the same as before for the excess of silver. The difference between these two results gives the amount of potassium cyanid that has been used by the formaldehyde in terms of N 10 ammonium sulphocyanate, and since each cubic centimeter of this is equal to 3 milligrams of formaldehyde, we can obtain the amount of formaldehyde that has been acted upon by the potassium cyanid.

The method used in the analysis of sample No. 26, examined in this laboratory, is as follows:

About 3 grams of the solution is weighed into a tall Erlenmeyer flask containing 25 to 30 cc of double normal sodium hydroxid. Fifty cc of pure 2.5 to 3 per cent fresh hydrogen peroxid is then gradually added, during a space of three minutes, through a funnel placed in the neck of the flask to prevent spurting. After standing ten minutes the funnel is washed with water and the unused sodium hydroxid titrated with double normal sulphuric acid, using litmus as indicator. By this method the formaldehyde is oxydized to formic acid, which is neutralized by the sodium hydroxid present.

While samples Nos. 65, 66, 67, and 26 I & W all contain less than 40 per cent formaldehyde by weight they contain 40 per cent or over by volume, so that the manufacturers are perfectly correct in claiming that their goods contain as much as 40 per cent of formaldehyde.

PETROLEUMS.

The results obtained by fractionally distilling four samples of crude petroleum are given in the following table:

TABLE XVI.—*Composition of crude petroleum.*

Temperature.	Character of distillate obtained.	Sample No. 275. ^b	Sample No. 276. ^c	Sample No. 277. ^d	Sample No. 278. ^c
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Below 50° C.					0.85
50°-70° C.	Petroleum ether.				2.06
70°-90° C.	Gasoline.				1.00
Below 80° C.	Light naphtha	1.49	0.14	1.89	
80°-120° C.	Heavy naphtha	4.35	1.63	9.26	
90°-120° C.	Naphtha				5.12
120°-150° C.	Benzine	5.03	3.82	9.04	5.35
150°-200° C.	Light burning oils.	7.64	13.48	10.73	13.70
200°-250° C.	Heavy burning oils.	13.54	12.03	15.80	12.49
250°-300° C.	Illuminating oils.				17.76
300°-315° C.	do.	68.70	68.62	45.60	23.93
315° C.—residue				7.70	16.98

^a Zeit für anal. Chemie, 1897, p. 19.

^b Specific gravity, 35° Baumé.

^c Specific gravity, 34° Baumé.

^d Specific gravity, 45° Baumé.

MISCELLANEOUS SOLID INSECTICIDES AND FUNGICIDES.

The analyses of a number of solid insecticides and fungicides that do not come under any of the previous headings are given in the following tables:

SULPHURS.

TABLE XVII.—*Composition of sulphurs.*

Constituents.	Sample No. 35.	Sample No. 36.
	<i>Per cent.</i>	<i>Per cent.</i>
Soluble sulphur.....	99.960	98.660
Insoluble sulphur.....	.144	.576
Lime.....	.000	Trace.
Foreign matter.....	.196	.764
Total.....	100.300	100.000

The total for sample No. 35 is given by the chemist who made the analysis as 100 per cent, but all the constituents added together amount to 100.3 per cent, as above.

PINE TAR INSECTICIDES.

[No. 73.]

This is an insecticide obtained from the destructive distillation of pine knots. It readily mixes with water and is slightly sticky and greasy.

BUG DEATHS.

TABLE XVIII.—*Composition of bug deaths.*

Constituents.	Sample No. 93.	Sample No. 223.
	<i>Per cent.</i>	<i>Per cent.</i>
Moisture.....	0.03	0.25
Lead oxid.....	1.58	2.01
Zinc oxid.....	78.86	86.80
Ferric oxid and alumina.....	3.80	5.20
Silica.....		2.96
Loss on ignition.....		2.43
Phosphoric acid.....		.03
Nitrogen.....		.04
Potash.....		.10

POTASSIUM CYANID.

[Nos. 23 and 1170 I & W.]

Sample No. 23 contained 53.12 per cent of potassium cyanid calculated from the cyanogen. The remainder of the sample appeared to consist principally of moisture and some potassium carbonate and chlorid. The method of analysis used was that described in Bulletin 68, Bureau of Chemistry.

Composition of potassium cyanid.

	[No. 1170, I & W.]	Per cent.
Cyanogen.....		40.49
Potassium		21.48
Sodium.....		23.74
Chlorin.....		8.98
Carbonic acid radical.....		1.98
Moisture.....		.82
Undetermined		2.51
		<hr/> 100.00

The above analyses show that both samples of potassium cyanid are very impure, although the second sample contains just about the amount of cyanogen demanded by theory.

NONPOISONOUS POTATO-BUG DESTROYER.

Composition of nonpoisonous potato-bug destroyer.

	[No. 137.]	Per cent.
Moisture.....		0.00
Nitrogen.....		.08
Ash		79.85
Potassium oxid .....		.00
Calcium oxid		68.20
Magnesium oxid		7.29
Ferric oxid and alumina		1.38
Phosphorus pentoxid.....		Trace.
Insoluble before calcination.....		7.29
Insoluble after calcination		1.50

As this analysis is not complete, no opinion as to the substances of which the mixture is composed can be expressed.

NONPOISONOUS INSECT EXTERMINATOR.

[No. 151.]

This sample contained 78.12 per cent of lime and 3.61 per cent crude carbolic acid, determined as ether extract. It had an odor of carbolic acid and appeared to be partly composed of carbolate of lime.

X. O. DUST.

[No. 176.]

Composition of X. O. Dust.

	Per cent.
Moisture.....	6.98
Organic and volatile matter	53.69
Carbon dioxid	3.40
Carbolic acid.....	Trace.

	Per cent.
Mineral matter.....	39.33
Sand	14.96
Ferric oxid and alumina	2.47
Calcium oxid	17.10
Magnesium oxid	2.09
Phosphorus pentoxid.....	.40
Potassium oxid.....	2.58

This mixture appears to be partly composed of carbonate of calcium with an excess of lime. No opinion as to the character of the organic and volatile matter can be based upon the data given, exclusive of the carbolic acid already mentioned.

ELECTRIC VERMIN EXTERMINATOR.

[No. 197.]

This insecticide is chiefly a mixture of calcium carbonate and calcium hydroxid with a very small amount of organic matter. Upon examination in this laboratory the organic matter present was found to consist of carbolic acid.

PAR' OIDIUM.

[No. 281.]

From the analyst's report this product would appear to consist of silicate of iron mixed with calcium sulphate. The analysis does not show the presence of sulphur and tobacco, both of which were found on examining a sample of the product in this laboratory.

ANTINONNIN.

[No. 282.]

A qualitative test of this substance showed that it contains dinitro-cresols, together with soap and glycerin.

MISCELLANEOUS LIQUID INSECTICIDES AND FUNGICIDES.

BOLLENE INSECTICIDE.

Composition of samples Nos. 305, 644, 645.

[No. 305.]

	Per cent.
Carbon bisulphid.....	47.8
Mineral and essential oils	12.2
Water and residue	40.0

This analysis was made in accordance with the Texas law (see p. 61) regulating the sale of Paris Green and other insecticides and is good only until May 1, 1903.

[Nos. 644 and 645 (I & W).]

Of the two samples of this product received at the Bureau of Chemistry one consisted of a black oil (644), while the other (645) separated into two layers, one a black oil and the other a white milky emulsion. The first sample was fractionally distilled as it stood, and the second sample was separated into its two parts and each part subjected to fractional distillation.

No. 644 (I & W), results of distillation test.

	Per cent.
Below 95° C	<i>a</i> 51.07
95°-108° C	<i>b</i> .41
108°-130° C	<i>c</i> .57
130°-160° C	<i>c</i> .90
160°-190° C	<i>c</i> 2.31
190°-220° C	<i>c</i> 6.15
220°-260° C	<i>c</i> 3.69
260°-300° C	<i>c</i> 13.46
300°-350° C	<i>c</i> 6.16
350° C. +	<i>c</i> 1.02
Loss and residue	14.26

a Practically all carbon bisulphid.*b* Penetrating odor of some essential oil.*c* Odor of petroleum products with paraffin which crystallizes out in the higher fractions.*No. 645 (I & W), results of distillation test.*

WHITE EMULSION, 81.28 PER CENT.

	Per cent.
Below 95° C	<i>a</i> 1.24
95°-108° C	<i>b</i> 76.10
108°-130° C	<i>c</i> 13.47
Loss and residue	9.19

BLACK OIL, 18.72 PER CENT.

	Per cent.
Below 40° C	<i>d</i> 43.48
40°-65° C	<i>d</i> 22.00
65°-95° C	<i>d</i> 5.53
95°-108° C	<i>e</i> .50
108°-130° C	<i>e</i> 4.84
130°-160° C	<i>f</i> 8.21
160° C. +	<i>f</i> 6.53
Residue and loss	8.91

a Odor of carbon bisulphid.*b* Mostly water with solid particles of paraffin.*c* Nearly all paraffin mixed with water.*d* Nearly all carbon bisulphid.*e* Some high-smelling essential oil present.*f* Mineral oils with odor of petroleum products.

It is evident from the analyses of the two samples of bollene insecticide made in the laboratory that the first one (644 I & W) consists of about 50 per cent carbon bisulphid and 50 per cent crude petroleum with a very small quantity of some essential oil having a strong odor, while the second (645 I & W) consists of about 62 per cent water, 14 per cent carbon bisulphid, and 23 per cent petroleum, with a little essential oil and a small quantity of soap. Whether or not a compound of this composition, which is evidently very variable, would kill the bollworm is a matter for experimentation.

The results of the analyses of these two samples were forwarded to the manufacturer, who in reply said: "This analysis is not at all correct, and since the analysis was made I have perfected my preparation." Another letter was then sent, asking in what particular the analysis was unsatisfactory, but to this no reply was received. The analyses of these samples was repeated, but the same results were obtained. Besides this it is found that the analyses made in this laboratory gave very much the same results as those made by the Texas authorities from a qualitative standpoint. Unless the results obtained by the Texas authorities and by this laboratory are approximately correct the manufacturer is selling all of his goods under a false label, since the Texas law requires that all insecticides sold in the State shall comply with the official analysis on every package.

EXCELSIOR INSECTICIDE AND WOOD PRESERVER, RED CEDAR BRAND.

[No. 63, I & W.]

Results of distillation test.

	Per cent.
(1) 80°-110° C.....	<i>a</i> 1. 01
(2) 110°-180° C.....	<i>a</i> . 31
(3) 180°-230° C.....	<i>b</i> 7. 42
(4) 230°-270° C.....	<i>b</i> 21. 91
(5) 270°-300° C.....	16. 50
(6) 300°-330° C.....	19. 11
(7) 330°-355° C.....	15. 84
(8) Residue and loss	17. 90

a Light oils with odor of benzene, toluene, etc.

b Give tests for phenol and cresols.

Fractions 4, 5, 6, and 7 are heavier than water. At about 340° C. the distillate begins to solidify in the condenser, and at 355° C. the condenser is so stopped up with naphthalene that it is necessary to cease distilling. This appears to be a sample of coal-tar creosote, and when properly used is of value both as an insecticide and a wood preserver.

FLY PREVENTATIVE.

[No. 202, I & W.]

Results of distillation test.

	Per cent.
(1) 80°-160° C.....	<i>a</i> 8
(2) 160°-215° C.....	<i>b</i> 7
(3) 215°-270° C.....	<i>c</i> 16
(4) 270°-350° C.....	<i>c</i> 19
(5) 350° C.....	<i>d</i> 33
(6) Residue and loss.....	<i>e</i> 17

a Light oil giving test for phenol and cresols.*b* Heavier oil giving test for phenol and cresols.*c* Thick oils.*d* Thick oil with solid particles.*e* Solid when cooling.

Fractions 1, 2, 3, 4, and 5 are all lighter than water. From the above analysis this sample appears to be a mixture of coal-tar creosote and petroleum. These substances are often used as fly preventatives.

KARBO KRESOLATE.

[No. 916, I & W.]

Results of distillation test.

	Per cent.
(1) 85°-105° C.....	<i>a</i> 26.4
(2) 105°-180° C.....	<i>b</i> 8.1
(3) 180°-220° C.....	<i>c</i> 7.6
(4) 220°-270° C.....	<i>d</i> 5.7
(5) 270°-285° C.....	<i>e</i> 8.8
(6) 285°-312° C.....	<i>e</i> 14.7
(7) Residue and loss.....	28.7

a Light oil and water mixed; smell of carbon bisulphid and benzine.*b* Light oil, test for phenol and cresols.*c* Oil, heavier than water, test for phenol and cresols.*d* Oil heavier than water.*e* Thick oil; pungent odor.

Fractions 3 and 4 contain solid naphthalene. A small amount of alkali is also present. From the distillation test it would appear that this sample consists of coal-tar creosote which has been boiled with resin and an alkali, or with resin, fatty matter, and alkali, to cause it to form an emulsion with water. From the size, appearance, and smell of the first fraction it also appears that some carbon bisulphid has been added. It is well known that creosote emulsions have given good results both as disinfectants and sheep dips. This preparation, therefore, would very likely be of value for the purposes intended.

PROFESSOR DE GRAFF'S CARPET BUG DESTROYER.

Composition of Professor De Graff's Carpet Bug Destroyer.

Constituents.	Sample No. 122.	Sample No. 129.
	<i>Per cent.</i>	<i>Per cent.</i>
Moisture.....	95.811	95.81
Residue from evaporation.....	4.189	.....
Mercury.....	.782	.78
Chlorin.....	.265	.27
Sulphur trioxid.....	.484	.48
Alumina.....	.904	.90
Potassium oxid.....	.267	.26

These two analyses are given in two different reports of the Massachusetts State Experiment Station, but were very likely made upon the same samples, since they are identical.

The active poisonous principle of this solution is evidently mercuric chlorid, which is often used for the destruction of various insects which infest houses.

III. STATE LAWS GOVERNING THE COMPOSITION AND SALE OF INSECTICIDES.

A circular letter was sent to the various experiment stations asking that they forward copies of the laws in their respective States relative to the composition and sale of Paris Green and other insecticides. In cases where the experiment stations could not furnish the information a similar request was made of the secretary of state. It is believed that the following compilation of State laws is a complete résumé of all such laws passed in the United States.

CALIFORNIA.

AN ACT to prevent fraud in the sale of Paris Green used as an insecticide.

The people of the State of California, represented in senate and assembly, do enact as follows: It shall be the duty of each and every manufacturer of Paris Green (commercial aceto-arsenite of copper) to be used as an insecticide within this State, and of every dealer in original packages of said Paris Green manufactured outside of this State, before the said Paris Green is offered or exposed for sale, or sold within this State as an insecticide, to submit to the director of the California experiment station, at Berkeley, samples of said Paris Green, and a written or printed statement setting forth: First, the brand of said Paris Green to be sold, the number of pounds contained in each package in which it is put on the market for sale, the name or names of the manufacturers and the place of manufacturing the same; second, the statement shall set forth the amount of combined arsenic which the said Paris Green contains, and the statement so furnished shall be considered as constituting a guarantee to the purchaser that every package of such Paris Green contains not less than the amount of combined arsenic set forth in the statement.

SEC. 2. Every purchaser of said Paris Green in original packages which is manufactured outside of this State, who intends to sell or expose the same for sale, and every manufacturer of said Paris Green within this State, shall, after filing the statement above provided for with the director of the California agricultural station, at Berkeley, receive from the said director a certificate stating that he has complied with the foregoing statements, which certificate shall be furnished without charge therefor. Said certificate when furnished shall authorize the party when receiving the same to deal in this State in the said Paris Green. Any person who fails to comply with the terms of section 1 of this act shall not be entitled to such certificate and shall not be entitled to deal in said Paris Green within this State. Nothing in this section shall be construed as applying to retail dealers selling said Paris Green which has already been labeled and guaranteed.

SEC. 3. Paris Green, when sold, offered, or exposed for sale as an insecticide in this State shall contain at least 50 per centum of arsenious oxide and shall not contain more than 4 per centum of the same in the uncombined state.

SEC. 4. The director of the California State agricultural station, at Berkeley, shall examine or cause to be examined different brands of Paris Green sold, offered, or exposed for sale within this State, and cause samples of the same to be analyzed, and

shall report results of analysis forthwith to the secretary of the State board of horticulture and to the party or parties submitting such samples, and such report shall be final as regards the quality.

SEC. 5. Any person or persons, firm, association, company, or corporation violating any of the provisions of this act, and any person who shall sell any package of Paris Green, or any part thereof, which has not been labeled as herein provided, shall be guilty of a misdemeanor, and shall be fined not less than \$50 nor more than \$200, together with cost of the suit, in an action caused to be brought by the State board of horticulture, through its secretary, in the name of the people of the State of California.

SEC. 6. The attorney-general of the State of California is charged with the prosecution of all such suits.

SEC. 7. This act will take effect immediately.—*Became a law by constitutional limitation February 28, 1901.*

LOUISIANA.

Act No. 131 of the general assembly of the State of Louisiana.

Be it enacted by the general assembly of the State of Louisiana, That the bureau of agriculture shall be charged with the duties of regulating the sale and purity of Paris Green as an insecticide in this State.

SEC. 2. That it shall be the duty of any manufacturer or dealer in original packages of Paris Green before the same is offered for sale in this State, to submit to the commissioner of agriculture a written or printed statement setting forth: First. The brand of Paris Green to be sold, the number of pounds contained in each package in which it is to be put upon the market for sale, and the name or names of the manufacturers and the place of manufacture. Second. The statement setting forth the amount of arsenic which they are willing to guarantee the said Paris Green to contain, and the statement so furnished shall be considered as constituting a guarantee to the purchaser that every package of said Paris Green contained not less than the amount of arsenic set forth in the statement.

SEC. 3. That every purchaser proposing to deal in Paris Green shall, after filing the statement above provided for with the commissioner of agriculture, receive from the said commissioner of agriculture a certificate stating that he has complied with the foregoing section, which certificate shall be furnished by the commissioner without any charge therefor; that the said certificate when furnished shall authorize the party receiving the same to deal in this State in Paris Green; that no person who has failed to file the statement aforesaid and to receive the certificate of authority aforesaid shall be authorized to deal in this State in Paris Green, and any person so dealing in this State without having filed the aforesaid statement and received the certificate aforesaid shall be liable for each violation to a fine not exceeding \$250, which fine shall be recoverable before any court of competent jurisdiction at the suit of the commissioner of agriculture or of any citizen, and shall be disposed of as hereinafter provided; provided, further, that nothing in this section shall be construed as preventing the sale by retail dealers throughout the State of Paris Green which has already been guaranteed and labeled as provided for in this act.

SEC. 4. That it shall be the duty of the board of agriculture, or its commissioner, at the opening of each season, to issue and distribute circulars setting forth the brands of Paris Green, their percentages of arsenic as claimed by the dealers, and to more particularly describe them they shall be separated into two classes, viz: First, those brands containing 50 per cent or more of arsenic shall be classed as "strictly pure," and, second, all falling below this percentage shall be classed as "impure."

SEC. 5. That it shall be the duty of the commissioner of agriculture to cause to be prepared labels of suitable material, fitted to be attached to packages of Paris Green and to have printed thereon "guaranteed," with a blank space into which there may

be stamped by the commissioner of agriculture the words "strictly pure," or "impure," as the guarantee may require; also the year or season in which it is to be used and a facsimile of the signature of said commissioner. The said labels shall be furnished by the said commissioner, to any dealer in Paris Green who shall have complied with the foregoing provisions of this act, upon the payment by said dealer to said commissioner of fifty cents for a sufficient number to label one hundred pounds of Paris Green.

SEC. 6. That it shall be the duty of every person, before offering for sale any Paris Green as an insecticide in this State, to attach or cause to be attached to each package one of the labels hereinbefore described, designating the quantity of Paris Green in the package to which it is attached. Any person who shall sell any packages of Paris Green, or any part thereof, which has not been labeled as herein provided for shall be guilty of a misdemeanor, and on conviction thereof shall be fined in the sum of one hundred dollars for each omission, which penalty may be sued for either by the Commissioner of Agriculture or any person for the uses hereinafter declared. Any person who shall counterfeit or use a counterfeit label prescribed by this act, or who shall use them a second time, shall be guilty of a misdemeanor, and on conviction thereof shall be fined in a sum not exceeding two hundred and fifty dollars, one-half of which shall be paid to the informer, which may be doubled or trebled at each second or third conviction, and so on progressively for subsequent convictions.

SEC. 7. That it shall be the duty of every person who sells a package of Paris Green, upon the request of the purchaser, to draw from the same and in the presence of the purchaser or his agent a fair or correct sample and to have the same securely enclosed and sealed and sent to the Commissioner of Agriculture for analysis by the official chemist of the State, and if upon analysis the said Paris Green shall be found below the guarantee given to the Commissioner of Agriculture and printed on the package, then the said seller shall be liable to the said purchaser for all damage accruing from said difference, recoverable in any court of competent jurisdiction in the State.

SEC. 8. That the copy of the official chemist's analysis of any Paris Green certified to by him shall be admissible as evidence in any court of the State on trial of any issue involving the merits of said Paris Green.

SEC. 9. That the Bureau of Agriculture shall adopt needful rules and regulations providing for the collecting of money arising from the sale of labels, or for any fines imposed under this act, and shall deposit the same with the Treasurer of the State.

NEW YORK.

AN ACT to amend the agricultural law, to prevent fraud in the sale of Paris Green.

The People of the State of New York, represented in Senate and Assembly, do enact as follows: Chapter three hundred and thirty-eight of the laws of eighteen hundred and ninety-three entitled "An act in relation to agriculture, constituting articles one, two, three, four, and five, of chapter thirty-three of the general laws," is hereby amended by adding a new article to be known as article eight and to read as follows:

SEC. 110. *State manufacturer and the dealer in original packages to file certificate with commissioner of agriculture.* After the passage of this act it shall be the duty of each and every manufacturer of Paris green within this state, and of every dealer in original packages of Paris green manufactured outside of this state, before the said Paris green is offered or exposed for sale or sold within this state, to submit to the commissioner of agriculture a written or printed statement setting forth, first, the brands of Paris green to be sold, the number of pounds contained in each package in which it is put upon the market for sale, the name or names of the manufacturers and the place of manufacturing the same; second, the statement shall set forth the amount of arsenic which the said Paris green contains, and the statement so furnished

shall be considered as constituting a guarantee to the purchaser that every package of such Paris green contains not less than the amount of arsenic set forth in the statement.

SEC. 111. *Certificate to be given by the commissioner of agriculture to state manufacturer and dealer in original packages.* Every purchaser of Paris green in original packages, which is manufactured outside of this state, who intends to sell or expose the same for sale, and every manufacturer of Paris green within this State, shall, after filing the statement above provided for with the commissioner of agriculture, receive from the said commissioner of agriculture a certificate stating that he has complied with the foregoing statement, which certificate shall be furnished without any charge therefor; said certificate when furnished shall authorize the party receiving the same to deal in this state in Paris green. Any person who fails to file the statement aforesaid shall not be entitled to such certificate and shall not be entitled to deal in Paris green within this State; nothing in this section shall be construed as applying to retail dealers.

SEC. 112. *Composition of Paris green or analogous products.* Paris green or any product analogous to it, when sold, offered or exposed for sale, as such, in this state, shall contain at least fifty per centum of arsenious oxide. (*See Amendment.*)

SEC. 113. *Paris green to be analyzed at experiment station.* The director of the New York State agricultural experiment station, at Geneva, shall, under the direction of the commissioner of agriculture, examine, or cause to be examined, the different brands of Paris green sold, offered, or exposed for sale within the State, and cause samples of the same to be analyzed, and shall report the result of the analysis forthwith to the commissioner of agriculture.

SEC. 114. *Penalty for violations.* Any person or persons, firm, association, company, or corporation violating any of the provisions of this act shall be guilty of a misdemeanor, and shall be fined not less than fifty dollars nor more than two hundred dollars; and in addition thereto shall forfeit and pay unto the people of the state of New York the sum of one hundred dollars, together with the costs of the suit in an action caused to be brought by the commissioner of agriculture in the name of the people of the state of New York, as provided by section eight of the agricultural law.

2. This act shall take effect immediately. *Became a law March 23, 1898, by the approval of the Governor. (Laws of New York, ch. 113.)*

AMENDMENT TO PARIS-GREEN LAW.

In accordance with the suggestion made by the New York State Experiment Station in 1900, that portion of the Paris Green law which related to the definition of Paris Green was changed. The essential portion of the amended law embodying this change is as follows:

SEC. 112. *Composition of Paris green or analogous products.* Paris green, or any product analogous to it, when sold, offered, or exposed for sale as such in this state, shall comply with the following requirements:

First. It shall contain arsenic in combination with copper, equivalent to not less than fifty per centum arsenious oxide.

Second. It shall not contain arsenic in water-soluble forms equivalent to more than three and one-half per centum of arsenious oxide.

OREGON.

Only those sections of the act named below which deal directly with the subject of insecticides are given.

AN ACT to protect the fruit and hop industry of Oregon.

SEC. 3. It shall be unlawful for any person, firm or corporation doing business in the State of Oregon to sell paris green, arsenic, london purple, sulphur or any spray material or compound for spraying purposes, in quantities exceeding one pound, without providing with each package sold a certificate duly signed by the seller thereof guaranteeing the quality and per cent of purity of said materials.

SEC. 4. Any person, firm or corporation selling any of the above materials which do not conform with the certificate furnished therewith shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be subject to a fine of not less than twenty-five (\$25) dollars nor more than one hundred (\$100) dollars.

SEC. 8. It shall be the duty of the Commissioner of the State Board of Horticulture of the district in which a violation of this act occurs to present the evidence of the case to the district attorney, whose duty it shall be to prosecute any person guilty of a violation of this act, which prosecution may be brought in any of the justice courts of this state.

SEC. 9. Inasmuch as the horticultural interests of the state demand immediate attention, this act shall be in full force and effect from and after its approval by the Governor. *Approved by the Governor, February 17, 1899.*

TEXAS.

AN ACT for the better protection of the farmer in the purchase of commercial fertilizers and commercial poisons used for destroying bollworms and other pests.

Be it enacted by the Legislature of the State of Texas: Before any commercial fertilizer or commercial poison, or any chemical or mixture used as a commercial fertilizer or commercial poison, such as London purple, arsenic, Paris green, or any poison used for the purpose of destroying the boll worm or other pests, is sold or offered for sale in this State, the manufacturer, agent, importer or party who sells or offers it for sale within this State shall deposit with the professor of chemistry of the Agricultural and Mechanical College a sealed tin can, bottle or jar containing not less than one pound of the fertilizer or commercial poison offered for sale; with an affidavit that it is a fair sample taken from several barrels, boxes, sacks, or from quantities in larger bulk, of the article thus to be sold or offered for sale; provided the unmixed substances, cotton seed meal, land plaster, salt, ashes, lime, green sand marl, uncrushed bones and animal excrements shall be exempt from the operation of the law.

SEC. 2. The manufacturer, importer, vender or agent of any commercial fertilizer or commercial poison, as referred to in Section 1 of this chapter, shall pay annually to the treasurer of the Agricultural and Mechanical College an analysis fee of fifteen dollars for each and every fertilizer or commercial poison sold, exposed or offered for sale within this State. Such payment shall be made at the time the sample of fertilizer or commercial poison is submitted to the professor of chemistry for analysis.

SEC. 3. After the analysis fee has been paid, as provided for in Section 2 of this chapter, it shall be the duty of the professor of chemistry of the Agricultural and Mechanical College to analyze or to have analyzed under his direction, any sample of a commercial fertilizer or commercial poison, in accordance with the requirements of the foregoing sections of the law. The professor of chemistry shall print the

result of such analysis in the form of a label, which shall set forth the name of the manufacturer, the brand of such fertilizer or commercial poison, and the essential ingredients contained in such fertilizer or commercial poison, viz:

1. Available nitrogen and its equivalent in ammonia.
2. Soluble phosphoric acid; total available phosphoric acid.
3. Reverted phosphoric acid.
4. Total phosphoric acid.
5. Potash soluble in water.

This, however, shall not preclude the professor of chemistry from setting forth any other ingredient which the fertilizer may contain. And he shall place upon each label the money value of such fertilizer or commercial poison, computed from its composition as he may determine. He shall furnish such labels in quantities of 500 or multiple thereof at a cost of one dollar per hundred; the money to be paid directly to the treasurer of the Agricultural and Mechanical College.

SEC. 4. Every box, barrel, keg, or other package or quantity of commercial fertilizer or commercial poison (within the limitations of Section 1 of this law), in any shape or form, sold or offered for sale in this State, shall have attached to it in a conspicuous place the label as provided for in Section 3 of this law, with the signature of the professor of chemistry attached.

SEC. 5. The professor of chemistry, or any duly authorized agent of his, is hereby authorized to select from any package of commercial fertilizer or commercial poison sold, or exposed for sale in this State, a quantity not to exceed two pounds, for a sample to be used for the purpose of an official analysis and for comparison with the sample furnished by the manufacturer, agent, or vendor, for official analysis.

SEC. 6. Any manufacturer, agent, or vendor of any commercial fertilizer or commercial poison who shall offer or expose for sale any such fertilizer or commercial poison without having previously complied with the provisions of this chapter shall be fined not less than fifty and not more than five hundred dollars for each violation or evasion of this law.

SEC. 7. Any agriculturist or farmer, a purchaser of any commercial fertilizer or commercial poison in this State, may take a sample of the same under rules and regulations to be prescribed by the professor of chemistry of the Agricultural and Mechanical College and forward the same to him for analysis, which analysis shall be made free of charge.

SEC. 8. The revenues accruing from analysis fees and sale of labels, as provided for in this chapter, shall be expended by the board of directors of the Agricultural and Mechanical College for the maintenance of the chemical department and for such other purposes as they may determine.

SEC. 9. A copy of the official analysis of any fertilizer or commercial poison, or chemical certified to by the professor of chemistry, shall be admissible as evidence in any court of this State on the trial of any issue involving the merits of said fertilizer or commercial poison.

SEC. 10. Whereas the fact that there is no law authorizing the analysis of commercial fertilizers and commercial poisons, or the testing of adulterated poisons when used for the purpose of destroying the boll worm and other pests, and the better protection of the farmer, creates an emergency, and an imperative public necessity that the constitutional rule requiring bills to be read on three several days be suspended and that this act take effect and be in force from and after its passage, and said rule is so suspended and it is so enacted. *Passed by the Twenty-sixth Legislature of Texas, 1899.*

WASHINGTON.

AN ACT to provide against the adulteration of Paris Green and other compounds used for spraying trees and plants.

Be it enacted by the Legislature of the State of Washington, That it shall hereafter be unlawful for any person, firm, or corporation doing business in the State of Washington to sell or offer for sale adulterated or low grade Paris green, arsenic, London purple, sulphur, or any spray material or compound for spraying purposes.

SEC. 2. For the purposes of this act Paris green shall contain not less than fifty per cent of arsenic trioxide in combination, and not more than four per cent of water-soluble arsenic trioxide, and commercial arsenic shall contain not less than ninety-six (96) per cent of arsenic trioxide.

SEC. 3. Any person, firm, or corporation violating any of the provisions of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than twenty-five dollars nor more than one hundred dollars. All fines imposed for violation of the provisions of this act shall be paid to the treasurer of the county wherein the violation was committed and placed to the general fund of such county.

SEC. 4. That the State Commissioner of Horticulture and the county fruit inspectors under his supervision be charged with the enforcement of this act, with the assistance of the prosecuting attorney.

SEC. 5. It shall be the duty of the chemist of the State Agricultural Experiment Station to correctly analyze, without extra compensation and without extra charge to the state other than the necessary expenses, all substances and compounds used or offered for sale for spraying trees and plants, that the State Commissioner of Horticulture may send for analysis, and report to him without unnecessary delay the result of any analysis so made; any such chemist shall assist him in prosecuting violations of the law, by giving testimony, expert or otherwise. *Approved by the Governor February 26, 1901.*

